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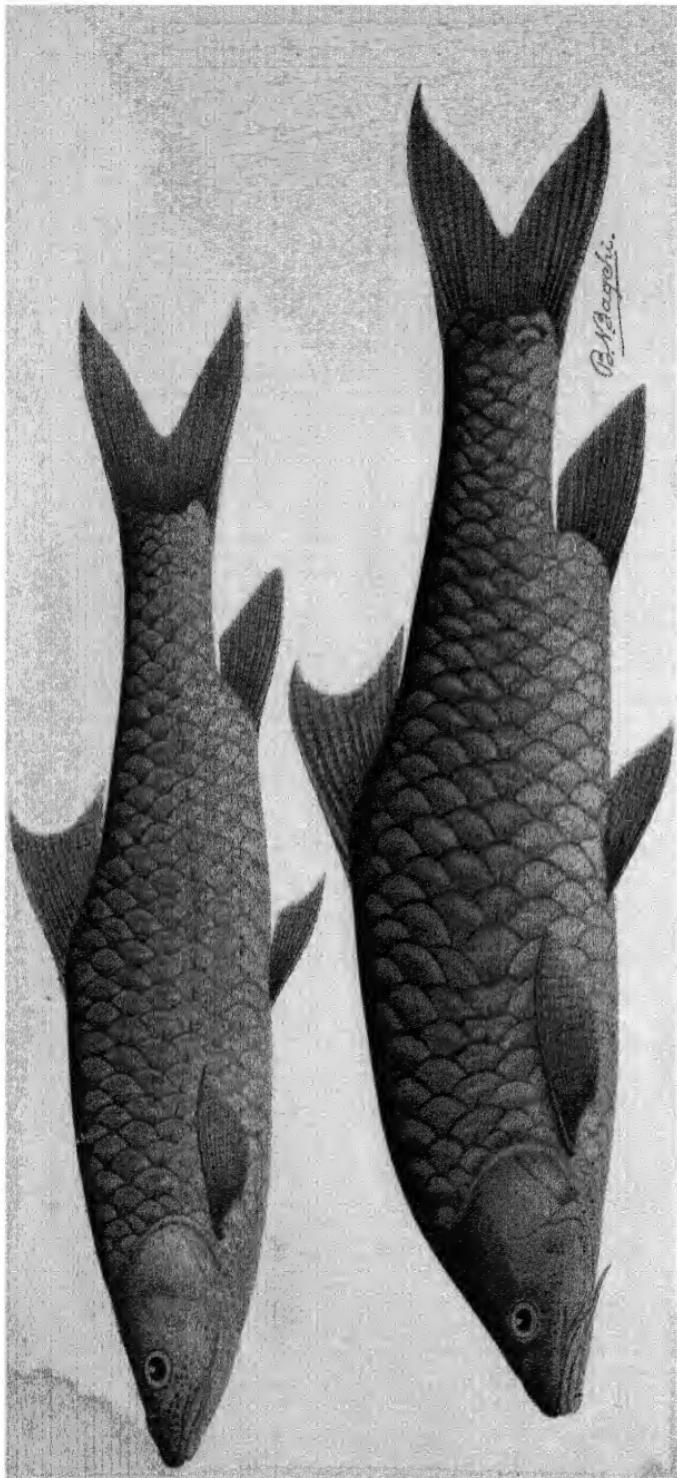
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TWO TYPES OF MAHSEER FROM THE POONA WATERWAYS.



Upper : BARBUS (TOR) KHUDREE Sykes. x ca $\frac{1}{2}$.

Lower : BARBUS (TOR) MUSSULLAH Sykes. x ca $\frac{1}{4}$.

The drawings were made from specimens and colour sketches supplied by Dr. M. Suter.

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NO. 1.

THE GAME FISHES OF INDIA.

BY

SUNDER LAL HORA, D.S.C., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I.,
Director of Fisheries, Bengal.

(With one coloured plate and three text-figures.)

(Continued from page 169 of Vol. XLIII, No. 2)

XVI.—THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

9. FURTHER OBSERVATIONS ON MAHSEERS FROM THE DECCAN.

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INTRODUCTION.

In the last article of this series (4)¹, attention was directed to the specific identity of Sykes's three species of *Barbus* from the Deccan, and it was shown that while *B. kolus* and *B. khudree* could be recognised as valid, doubts still existed about the identity of

¹ Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

B. mussullah. From the evidence then available, it seemed possible that *B. mussullah* might be the same fish which Hamilton (3) had previously described from Mysore as *B. curmuca* and which was later recorded from the Deccan also. However, a detailed consideration of the systematic position of this species was deferred till Dr. M. Suter had an occasion to carry out further investigations at Sirur, the type-locality of *B. mussullah*. He has now completed his studies and favoured me with the following report in his letter dated December 8, 1942. He writes:—

'I have now been to Sirur, Sykes's type-locality for his *Barbus mussullah* mainly in order to ascertain as definitely as possible whether *Barbus curmuca* occurs in the Ghod river and whether it is known to the local fishermen.

'The information elicited on hand of a preserved specimen and with the help of the excellent coloured picture from the pamphlet of the *Bombay Nat. Hist. Society* "Game Fishes of Bombay" proved entirely negative, i.e., neither the specimens nor the illustration were recognised as representing a fish of local occurrence, or at all known to local fishermen. A resemblance to *B. kohli* was indeed remarked upon and I was asked whether this (*B. kohli*) was the fish I wanted to know about.

'As you relate in your article in the August number of B. N. H. Society's *Journal*, the same men, on a former occasion, picked a picture of *B. curmuca* (out of the illustrated volume of Day's *Fishes of India*) as representing "*mussullah*" out, when later on they showed me a catch of very large high-backed mahseer, they assured me that this was "*mussullah*" and admitted that their identification of Day's picture had been an error caused mainly by the fact that they thought the shape of the head in the picture seemed to them a good likeness of the head of "*mussullah*", being somewhat "roman nosed".

'They also criticised Sykes's drawing of "*mussullah*" as being correct for the head, but wrong for the body, the scales being too small and too many.

'The position is now as follows

1. *Barbus curmuca* is not known to the professional fishermen at Sykes's type-locality for *B. mussullah*.

2. The sturdy and high-backed species of mahseer of the Deccan is the only fish known to these men by the name of "*mussullah*" and most of the men differentiate it clearly from the slenderer species of mahseer (*Barbus khudree* Sykes).

3. Sykes expressly relates having been given a specimen of "*mussullah*" weighing 42 lbs. at Sirur, and the local fishermen repeatedly stated to me that the high-backed mahseer was the only fish with large scales known to them, whichever reached such a size or exceeded it.

The only other big fish with prominent scales known to the men are, *B. khudree*, *B. dobsoni* (= *jerdoni*), *Labeo calbasu*, *L. porcellus*, and *L. fimbriatus*.

4. The designation "*mussullah*" is also used by the fishermen of the Bhima and Idrayam rivers for large mahseer only, and many of the men use it for the high-backed species only, expressly differentiating it from the slenderer *B. khudree* Sykes, for which they have other designation, such as *khudchee*, *barsa*, etc.

Others, whilst quite aware of the difference between the two types of mahseer, will apply the name of "*mussullah*" to large specimens of both types. The more observant ones, however, will not do so.

'Faced by the above result of my investigations at Sykes's locality I cannot but arrive at the conclusion, that the fish to which Sykes applied the name of *B. mussullah*, was none other than the stockily-built and high-backed mahseer of the Deccan.

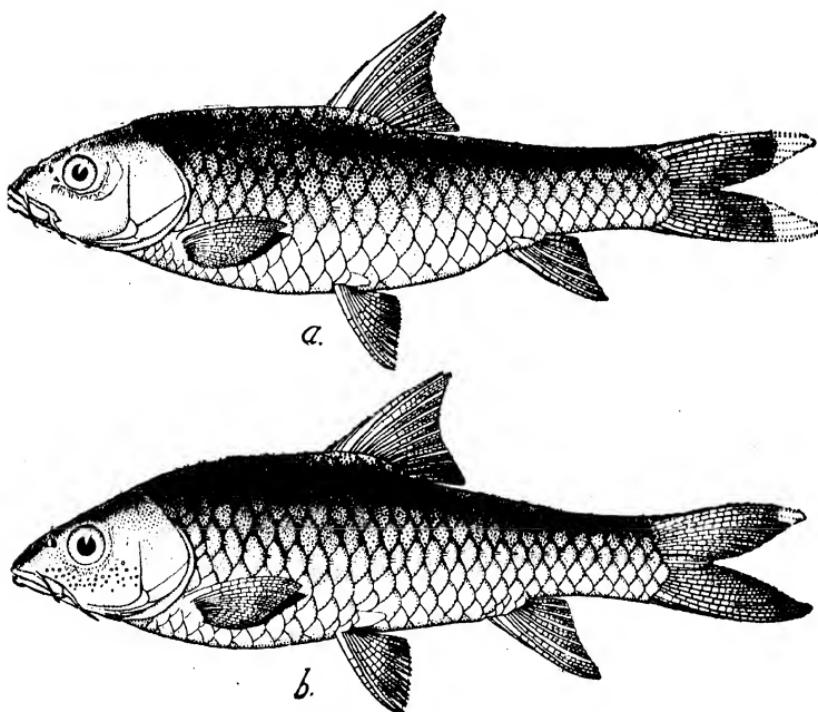
'The uncertainty prevailing for so long in respect of the identity of Sykes's species was caused by his incomplete description in respect of scale counts, and by the undoubtedly incorrectness of the drawing prepared by his employee, in which the scales were filled in haphazardly without any count having been taken.

'I have no doubt that you will arrive at the same conclusion and that thereby, the question will have arrived at its final elucidation.'

All ichthyologists and lovers of sport will ever remain grateful to Dr. M. Suter for the great trouble taken by him in elucidating the taxonomic position of Sykes's *B. mussullah* as there seems no doubt now that in describing this fish he intended to portray the high-backed mahseer of the Deccan waters. The difference in form between the two species of Deccan mahseers is clearly shown in the drawings on the coloured plate.

Dr. Suter has found both species of the Deccan mahseer pretty foul feeders at times. During the rains, he found them at such unsavoury spots as the place of discharge of surplus municipal sewage and has repeatedly seen them consume fresh buffalo dung.

Though the young of the various kinds of mahseer generally look alike, and the differences pointed out by Annandale (1) between the two species of Deccan mahseer are not very distinctive, it is quite possible that his *masundi* of the Upper Kistna may represent



Text-fig. 1.—Lateral views of young specimens of Annandale's two species of Mahseer from the Deccan.

(a) *Barbus tor* (Hamilton), known near Satara as *Kudis*, \times ca. $\frac{1}{4}$.
This is probably a young of *B. khudree* Sykes.

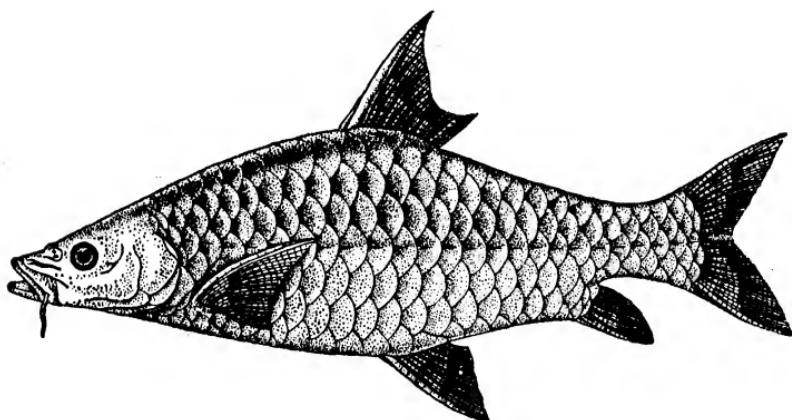
(b) *Barbus mussullah* Sykes, known near Satara as *Masundi*, \times ca. $\frac{1}{4}$.

Barbus mussullah and his *B. tor*, locally known as *Kudis*, may be *B. khudree*. To facilitate reference in future, I give here drawings of Annandale's young specimens of the two species.

The remarkable shape of Sykes's *B. mussullah* did attract the attention of later ichthyologists, but owing to his defective description and figure they could not identify it correctly. For instance, in recording *Barbus megalepis* McClelland from South India, Jerdon (5) stated:—

'I obtained a single small specimen of what I consider may be this fish in the Cauvery at Seringapatam. It was only a few inches long, but the fishermen, who call it *Kilche*, said it grew to an enormous size.'

The fish that grows to an enormous size in the Cauvery and its tributary streams, such as the Bhavani River, is figured and described by Thomas (6, pp. 22, 23) under the composite name *Barbus*



Text-fig. 2.—The Bawanny Mahseer of Thomas (Reproduced from *Rod in India*).

tor in accordance with Day's (2, p. 573) nomenclature, though he seemed to have been aware of the fact that 'there are more Mahseers than have been named'. Thomas called it 'The Bawanny Mahseer' and noted that it is much deeper and more high backed than the other Mahseers. From his figure, reproduced here, it can be seen that the fish is pointed towards both ends. According to Thomas, it has a rich golden hue which shines on the gill-cover and forms predominant colour of every scale. It is known as 'Bom-min'.

Some years ago, Mr. S. H. Prater of the Bombay Natural History Society sent me a colour sketch of a baby Mahseer, $16\frac{1}{2}$ inches long and $1\frac{1}{2}$ lbs. in weight, caught by Messrs Van Ingen and Van Ingen of Mysore in the Bhavani River. The local name of the fish was given as *Kargolchi*. Though the colouration of this specimen, as shown in the sketch, is different from that of the Poona examples of *B. mussullah*, there seems hardly any doubt about its identity. It would thus appear that Sykes's *mussullah* is fairly widely distributed

in the rivers of the Western Ghats. This remarkable mahseer may be redescribed as follows:—

Barbus (Tor) mussullah Sykes.

1838. *Barbus mussullah*, Sykes, *Proc. Zool. Soc. London*, p. 159.
 1840. *Barbus mussullah*, Sykes, *Ann. Mag. Nat. Hist.*, IV, p. 56.
 1841. *Barbus mussullah*, Sykes, *Trans. Zool. Soc., London*, II, p. 356.
 1849. *Barbus megalopis*, Jerdon (*nec McClelland*), *Madras Journ. Litt. & Sci.* XV, p. 311.
 1897. The Bawanny Mahseer, Thomas, *Rod in India*, 3rd Edition, pp. 22, 23.

D. 4/9; A.3/5/; P.16; V.9; C.19; L.l.25-26; L.tr.4½/5½.

Whereas the Khudree Mahseer corresponds with the Mosal Mahseer of the Himalayan waters, Mussullah is similar in certain respects to the Tor Mahseer. In the Tor Mahseer, however, the head is always smooth, while in Sykes's species there are series of small tubercles, sometimes indistinct, on the sides below the eyes. The head is considerably shorter than the depth of the body, more particularly in older individuals, and the general build is stocky and heavy. The form is more or less spindle-shaped as both the profiles are considerably arched; the dorsal profile rises considerably from the tip of the snout to the base of the dorsal fin and then sharply slopes down to the base of the caudal fin. The ventral profile is comparatively gently arched. The head is pointed anteriorly; in mature specimens its length is contained about 5 times in the total length and 4 times in the length without the caudal. The depth of the body is contained from $3\frac{1}{2}$ to $3\frac{3}{4}$ times in the total length and little over 3 times in the length without the caudal. The eye is small and is situated in the anterior half of the head; its diameter is contained about 6 times in the length of the head. The mouth is small and slightly slanting; the maxillary barbels are longer than the rostrals. The relative proportions of different parts vary considerably with age as can be readily made out from the table of measurements. The dorsal fin is situated in the middle of the back and possesses a strong, bony dorsal spine. All the fins are more or less pointed. The scales are large and well set; there are about 26-27 scales along the lateral line and $3\frac{1}{2}$ rows below it to the base of the pelvic fin.

The colouration varies considerably. The young ones are rather silvery on the sides with pink reflexes, a creamy belly and slaty back and fins. In some large specimens the colour is very dark with bronzy reflexes. The bases of the scales below the lateral line are bluish gray while their margins are creamy. Generally the ventral surface is reddish cream. The dorsal surface is dark bronze. The bases of the scales in the upper half are mauvish gray while the bodies are reddish bronze with darker margin. The fin rays of the dorsal and caudal fins are reddish gray, while the interspinous membranes are bluish gray. The other fins are reddish gray, and all the fins are shot with bright blue streaks which are very prominent in the caudal.

The colours are more golden and reddish orange in the specimens from the Bhavani River. It would thus appear that whereas the predominant colour of the two Mahseers of the Deccan is bluish in-

the Poona waterways, it is reddish in the specimens found in the Cauvery and Bhavani Rivers much further south.

TABLE OF MEASUREMENTS.

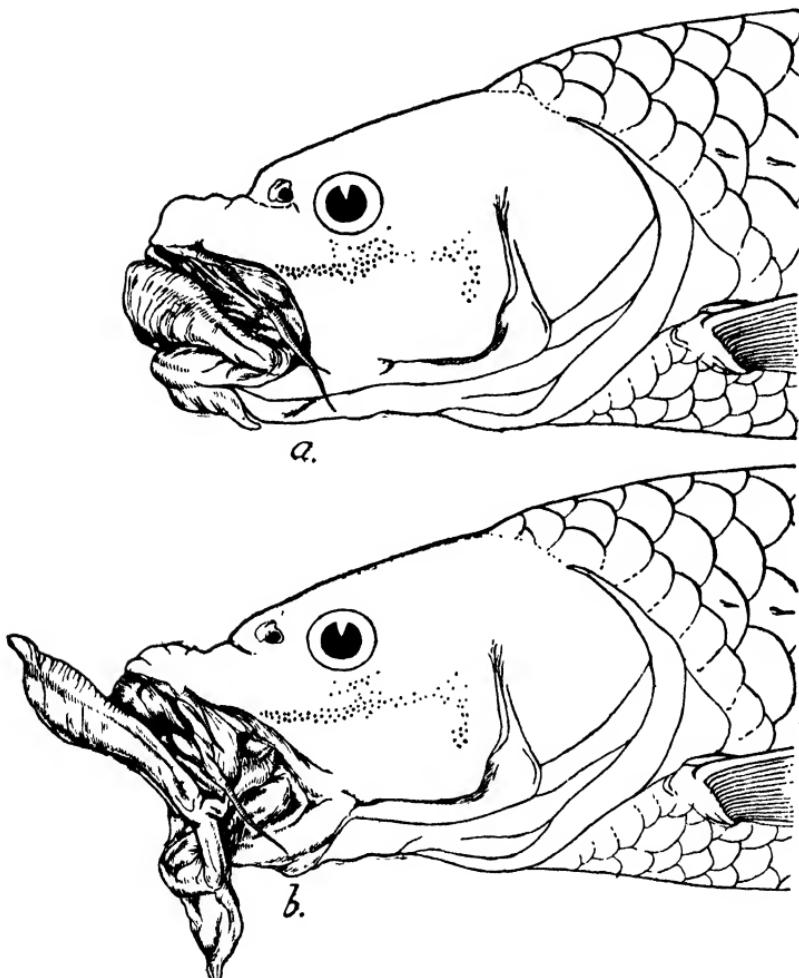
Measurements in millimetres and scale counts of Barbus (Tor) mussullah Sykes

Total length ...	148·0	270·0	275·0	622·0	750·0
Standard length ...	115·0	215·0	225·0	494·0	600·0
Length of head ...	33·0	58·0	60·0	125·0	149·0
Width of head ...	17·0	32·0	35·5	85·0	102·0
Diameter of eye ...	8·0	9·0	10·5	17·0	28·0
Length of snout ...	10·0	21·0	22·0	46·0	45·5
Interorbital distance	10·0	23·0	22·0	51·0	61·0
Width of body ...	16·0	35·0	Eviscerated		71·0
Depth of body ...	38·0	73·0	81·5	166·0	231·0
Length of caudal peduncle ...	16·0	35·0	33·0	91·0	106·0
Least height of caudal peduncle ...	15·0	29·5	30·0	63·0	82·0
Length of dorsal fin	29·0	52·0	52·0	99·0	120·0
Length of pectoral fin	23·0	43·0	42·0	96·0	125·0
Length of pelvic fin	21·0	39·0	38·0	88·0	104·0
Length of anal fin	25·0	44·0	45·0	95·0	109·0
Length of rostral barbel	6·5	12·0	12·0	27·0	30·0
Length of maxillary barbel ...	9·0	15·0	16·0	37·0	42·0
No. of predorsal scales ...	10	10	10	10	11
No. of scales along L. 1. ...	26	26	26	27	27
No. of scales between L. 1. and V. ..	3 $\frac{1}{2}$	3$\frac{1}{2}$	3$\frac{1}{2}$	3$\frac{1}{2}$	3$\frac{1}{2}$
Scales round caudal peduncle.	13	12	13	12	12

Barbus (Tor) khudree Sykes.

In the preceding article of this series (4), it was stated that the sketches and specimens of *B. khudree* received from Dr. Suter would be dealt with later, but the transfer of the Zoological Survey of India to Benares for the duration of the war has made it impossible for me to comment in detail on them. It can, however, be stated with certainty that the material is similar to that collected by Dr. Fraser at Deolali and Poona.

A female mahseer, $5\frac{1}{2}$ lbs. in weight, taken by Dr. Rishworth on the 20th December, 1942, in the Uhlas, a small river about 40



Text-fig. 3.—Head and anterior part of body of *Barbus (Tor) khudree* Sykes, showing hypertrophied lips. The specimen was collected by Dr. Rishworth in the Uhlas River, 40 miles north of Bombay. $\times \frac{1}{2}$.

(a) Lips and mouth closed; (b) Lips and mouth protruded.

In the fresh condition, Dr. Rishworth found that the lips could be extended much further than shown in the drawings made from preserved specimens.

miles north of Bombay flowing into the Arabian Sea from the western slopes of the Ghats, has been identified as *B. khudree*. It is one of the few specimens of mahseer which have been collected from the cis-Ghat area and is characterized by greatly hypertrophied lips. The accompanying sketches show the lips and mouth protruded and closed. The colour of the specimen was similar to that found in the Deccan examples of this species, but the fins were tipped with

yellowish pink. Its stomach contained green vegetable matter. The following further particulars about this specimen were supplied by Dr. Rishworth:—

Measurements in inches and number of fin rays.

Total length	...	...	25·0
Standard length	...	...	20·0
Length of head	...	...	6·25
Depth of body	...	...	5·5
Height of caudal peduncle	...	...	2·25
Girth of caudal peduncle	...	...	5·25
Dorsal	...	...	9
Anal	...	...	7
Pelvic	...	...	15
Ventral	...	...	9

From the observations on the colouration of the species made by Dr. Suter, it appears that in the Poona Waterways the colour is silvery bluish gray below the median line and almost creamy yellowish white on the ventral surface. The colour is darker above the lateral line, the bases of the scales being gray and their margin reddish gray. The colour of the back is dark olive. The head is dark olive above and creamy yellowish white below. The fins are bluish gray. The colour drawing of *B. khudree* reproduced here shows the general colouration of the species in the Poona Waterways as noted by Dr. Suter. Living fish as seen in clear water look reddish bronze in the back.

ACKNOWLEDGMENTS.

I am indebted to Dr. M. Suter for specimens, colour sketches and observations on the Mahseers of the Deccan, and to the authorities of the Bombay Natural History Society for bearing the entire cost of the illustrations. I am also thankful to Babu B. Bagehi for the skill and care with which he prepared the illustrations under my supervision.

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EXPLANATION OF PLATE.

Two types of Mahseer from the Poona Waterways.

Upper: *Barbus (Tor) khudree* Sykes. \times ca. $\frac{1}{2}$.
 Lower: *Barbus (Tor) mussullah* Sykes. \times ca. $\frac{1}{2}$.

The drawings were made from specimens and colour sketches supplied by Dr. M. Suter.

THE BIRDS OF MYSORE.

BY
SALIM ALI.

With notes by Hugh Whistler.

PART IV.

(Continued from Vol. xlii, No. 4, p. 595).

Hierococcyx sparverioides (Vigors) The Large Hawk-Cuckoo.Specimens collected: *Biligirirangans*: M9(H) ♂ 10-3-34, M48(G) ♂ 29-10-34 (5,000'—Honnametti).

Not met with by the Survey.

[Measurements :

	Bill	Wing	Tail
1 ♂ ad.	39	224	— mm.
1 ♂ imm.	29	223	— mm.—H. W.]

Status? Evidently rare.

Hierococcyx varius Vahl. The Common Hawk-Cuckoo.Specimens collected: 162 ♂ 24-11-30 Maddur (2,500'); 184 ♂ 28-11-30 Antarsānti (2,500'), 263 ♂ 4-12-39 Karāpūr (2,500'); 460 ♀ 26-12-39 Dodballāpūr (2,000'); 641 ♂ 15-1-40 Sākleshpūr (3,000'); 682 ♀ 20-1-40 Bābābūdān Hills (5,000'—Kemmangundi). *Biligirirangan Hills*: ♂ 21-12-32, M37(H) ♂ 5-3-34 (4,000'-5,000'—Honnametti).

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
3 ♂ ♂ ad	25-28	193-199	168 mm.
1 ♀ ad.	—	194	156 mm.
3 ♂ ♂ imm.	25-27.5	183-186	160-161 mm.
1 ♀ imm.	28	188	(missing)—H. W.]

Evidently resident. Not common but frequent. Met with singly in both deciduous and evergreen biotopes and throughout the intermediate zone. Between November and March the birds were silent and no 'Brain-fever' calls were heard.

Cacomantis merulinus passerinus (Vahl) The Plaintive Cuckoo.

Specimens collected: 383 ♂ (hepatic) 19-12-39 Māklidūg (2,800'—Bangalore Dist.).

Elsewhere noted: Settihälli. (This or *Penthoceryx sonnerati*? Unconfirmed).

[Measurements 1 ♀ Bill 22, Wing 118, Tail 105.5 mm.

This is an adult female of the 'hepatic type.' It is moulting the wings and body, and it is important to note that it is moulting from 'hepatic' to 'hepatic' plumage—H. W.]

Status? The specimen was a solitary in dry, deciduous, broken scrub-and-bush country.

Clamator jacobinus jacobinus (Bodd.) The Pied Crested Cuckoo.

Specimens collected: 91 ♂ 17-11-39 Bandhpūr (3,300'); 298 ♀ 8-12-39 (2,000'—Seringapatām).

Elsewhere noted: Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
1 ♂	25	148	160 (worn) mm.
1 ♀	26.5	137.5	164 mm.

No. 91 ♂ is slightly larger than any other male of this race which I have examined. (Wing 138.5-140), but I think there is no doubt that it belongs to this race as there is no authentic record of the larger race below Bombay and the Central Provinces.—H. W.]

Status? Met with in deciduous biotope—lightly wooded country about villages and cultivation.

No. 91 was excessively fat, a circumstance which—in view of Mr. Whistler's remarks above—suggests that it *may* possibly belong to the northern race *pica* (believed to winter in Africa) preparing, rather late, for emigration.

Eudynamis scolopaceus scolopaceus (Linn.). The Koel.

Specimens collected : 96 ♂ 18-11-39, 158 ♂ 24-11-39 Bandipur (3,300'), 244 ♂ 3-12-39 Antarsāntē (2,500'); 506 ♂ 29-12-39 Thōndēbhāvi (2,500'); 635 ♂ 15-1-40 Sakleshpūr (3,000'); *Bilgirrangan Hills* : M14(G) ♂ 15-9-34, M28(G) ♀ 21-9-34, M49(G) ♀ 25-9-34 (2,000'—Satyamangala).

Elsewhere noted : Nāmadachilumē (3,000'—Tūmkūr Dist.).

[Measurements :

	Bill	Wing	Tail
4 ♂ ♂ ad.	30-33.5	188-202	177.5-195 mm.
3 ♀ ♀ ad.	30-34	192-203	192-193 mm.
1 ♀ juv.	—	188	188 mm.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects lightly wooded country about villages and cultivation with large leafy green trees as of banyan and tamarind, interspersed.

No. 96 (18 November) was very fat. Major Phythian-Adams has an egg taken from a crow's nest at Gündlüpet, 25-8-1929.

Rhopodytes viridirostris (Jerdon). The Small Green-billed Malkoha.

Specimens collected : 93 ♂, 94 ♂ 18-11-39 Bandipur (3,300'); 228 ♂ 1-12-39 Antarsāntē (2,500'), 345 ♀ 15-12-39 Sātnūr (2,500'); *Bilgirrangan Hill* : M40(H) ♂ 5-4-34 (4,000'—Honnametti); M12(G) ♀ 8-8-34, M21(G) ♀ 10-7-34, M66(G) ♂ 19-7-34 (3,000'—Cudahatti, Eastern base).

Elsewhere noted : Jōgumaradi (3,400'—Chitaldrūg town environs); Hiriyūr.

[Measurements :

	Bill	Wing	Tail
4 ♂ ♂	29-31.5	131-143	202-246 mm.
3 ♀ ♀	28-32.5	131-135	220-225 mm.
1 ♂ juv.	29.5	133	213 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects thin secondary, and scrub-and-bush jungle.

The ovary of No. 345 (15 December) was maturing; largest follicle over 2 mm. Major Phythian-Adams has a c/2 taken near Gündlüpet, 12-6-1935.

Taccocua leschenaultii subsp. The Sirkeer Cuckoo.

No specimen.

Noted : Sātnūr. A pair in deciduous heavily thorn-scrubbed ravine, 15-12-39.

Centropus sinensis parroti Stres. The Southern Crow-Pheasant.

Specimens collected : 194 ♀ 29-11-39 Antarsāntē (2,500'); 562 ♂ 8-1-40 Marikānivē (2,500'). *Bilgirrangan Hills* : M2(H) ♀ juv. 7-5-34, M76(M) ♀ 16-5-34 (4,000-5,000'—Bellājī).

Elsewhere noted : Edbūthi (Bilgiris), Bandipur, Nāmadachilumē, Settihālli.

[Measurements :

	Bill	Wing	Tail
2 ♀ ♀ ad.	38-42	180-203	247-260 mm.
1 ♂ juv.	38.5	181	248 mm.
1 ♀ juv.	35	170	184 mm.

Both these juveniles are exactly like the adults in colouration whereas most if not all adults of *C. sinensis sinensis* in N.-W. India have a conspicuously different barred plumage. It will probably prove to be a racial characteristic. —H. W.]

Resident. Not common; occasional solos. Confined to deciduous biotope. Affects lightly wooded and scrub-and-bush country, usually about cultivation.

No. 562 was infested with the cestodes *Raiettina (Skrjabinia) centropi* (Southwell, 1922) in the body cavity (or intestine?).

Psittacula eupatria subsp. The Alexandrine Parakeet.

No specimens.

Noted Settihalli (— A flock of 8 in teak and bamboo forest on 27 January, and again a small flock on 2 February); Kolār Gold Fields (Solo, 21-2-40).

Psittacula krameri manillensis Bechst. The Rose-ringed Parakeet.

Specimens collected: 438 ♂ 24-12-39 Dodballapur (2,900'); 511 ♂ 31-12-39 Nāmadachilumē (3,000').

Elsewhere noted. Heggadadevankotē, Karāpūr, Kolār Gold Fields.

[Measurements: 2 ♂♂ Bill from cere 23-25, Wing 167-172, Tail 218-238 mm.

It is interesting to note that from the size of the organs (testes 12×6 and 12×5 mm.) both these males were about to breed in immature and female-like dress—H. W.]

Resident. Not common. Confined to deciduous biotope. Found in fairly wooded country, usually around cultivation.

The specimens, with testes 12×6 and 12×5 mm. respectively were either breeding or about to breed.

Psittacula cyanocephala cyanocephala (Linn.) The Western Blossom-headed Parakeet.

Specimens collected: 114 ♂ 19-11-39 Bandipūr (3,300'), 538 ♂ 4-1-40 Nāmadachilumē (3,000'), Biligirirangan Hills: 20 ♂ 8-11-39 (3,500'—Bedagūli); M17(G) ♀ 10-7-34 M111(G) ♂ 3-8-34 (3,000'—Cudahatti, E. base).

Elsewhere noted. Devarbetta Hill, Jāgar Valley (Bābābūdāns), Settihalli.

[Measurements:

	Bill (from cere)	Wing	Tail
2 ♂♂ ad.	18-19	138-142	191-215 mm
1 ♀ ad.	17	132	—
1 ♀ imm.	16	133	— H. W.]

Resident. Fairly common. Confined to deciduous biotope, but it also extends far into the intermediate zone. In the Bilgirirangans it was a noticeable feature that this species occurred in the deciduous and semi-evergreen forest (in the last coincident with *columboides*) up to about 3,500 ft. elevation, but that it was entirely replaced by *columboides* higher up as the vegetation took on an increasingly evergreen aspect.

Along with the next species this parakeet is very destructive to crops of jowāri and the vetch *Dolichos lablab* (Linn.) (Canarese *aorē-khāī*)¹ cultivated in forest clearings.

In specimen No. 538 (4 January) the testes measured 6×4 mm. and were evidently maturing.

Psittacula columboides (Vigors). The Blue-winged Parakeet.

Specimens collected: 350 ♂ 15-12-39 Devarbetta Hill (3,000'); 611 ♂ 13-1-40 Sakkleshpūr (3,000'); 769 ♀ 29-1-40 Settihalli (2,500'); 849 ♂ 8-2-40 Agūmbē (2,500'). Biligirirangan Hills: 34 ♂ 10-11-39 (4,000'—Bedagūli); ♂ 18-12-32, M11(H) ♂ 16-3-34, M17(H) ♂ 24-2-34, M61(H) ♂ 24-4-34.

¹ The Forest Guard when asked whether this was used as food explained that 'it is only used for putting into bag and tying to nose of horse'!

M13-14(H) ♂♂ 8-5-34, M40-41 ♀♂ 11-5-34 (4,000-5,000' Honnametti); M82 (H) ♂ 18-5-34 (5,000'—Bellaji); M36(G) ♂ 14-7-34 (3,000'—Udahatti, Eastern base).

Elsewhere noted: Bandipur, Antarsanté, Karapur, Bābābūdan Hills (Jāgar Valley 2,500'; Kemmangundi 4,500').

[Measurements:

	Bill (from cere)	Wing	Tail
9 ♂♂ ad.	22.5-24	143.5-156	204.5-246 mm.
1 ♀ ad.	23	144.5	167 mm.
4 ♂♂ juv.	21.5-23	140.5-152	148-164 mm.
1 ♀ juv.	20	143.5	163 mm.

This species has not been recorded before so far east as the Biligirirangan Hills and Devarbetta Hill.—H. W.]

Resident. Common. Confined to evergreen biotope, but freely entering the intermediate zone to about the same limit as *cyancephala* does from the deciduous end. The distribution of the Δ species overlaps at its seam.

It is the only parakeet found in the coffee estates and may invariably be seen eating the nectar from the *Grevillea* and *Erythrina* flowers of the shade trees planted here.

This species, prized by fanciers as the 'Bābābūdan Parrot' has acquired an almost universal reputation in Mysore State (and doubtless beyond) as a talking paragon. It is accredited with being an exceptional linguist and believed to address human beings in Arabic! The foundation for this widespread belief appears to be that one Bābūddin, a pilgrim from Mecca (and incidentally the originator of coffee-planting in South India) who settled on the hills that now bear a semblance of his name (Bābābūdan), kept a local parakeet (or several parakeets?) whom he taught to call to Allah and recite verses from the Koran. Whether some of his trained parrots escaped or were artfully released after completing their novitiate is not clear. But they were regularly fed and so kept near the abode of this holy man. To his glorification they caused open-mouthed wonderment amongst the devout who pilgrimaged to the saint periodically and who helped afterwards to broadcast the magical piety of Bābūddin and the spell it had cast upon the parakeets of the locality.

Coryllis vernalis (Sparrm.) The Indian Loriquet.

Specimens collected: 113 ♀ 19-11-30 Bandipur (3,300'); 250 ♂ 3-12-39 Karapur (2,500'); 643 ♀ 16-1-40 Sakleshpur (3,000'), 687 ♂ 20-1-40 Bābābūdan Hills (Jāgar Valley 2,500'); 791 ♂ 31-1-40 Settihalli (2,500'), 858 ♂ 11-2-39 Jōg (2,000'), Biligirirangan Hills. M55-56(G) ♂ ♀ 10-7-34, M91-92(G) ♂ ♂ 25-7-34 (3,000'—Udahatti, E. base)

Elsewhere noted: Bedaguli (3,500' Biligiris), Antarsanté, Agumbe.

[Measurements.

	Bill (from cere)	Wing	Tail
5 ♂♂	11-12	91-96	38.5-43.5 mm.
2 ♀♀	11	96.5-99.5	45-47 mm.

In the Eastern Ghāts Survey (J.B.N.H.S., xxxvii, 754) I expressed my hesitation at keeping up the race *rubropygialis* for birds of the southern distribution of this species. The examination of this series and some new skins from Assam has satisfied me that the race cannot be maintained. The supposed differences on which it is based do not appear to hold good, being either individual or due to wear.—H. W.]

Resident. Common. Essentially an inhabitant of the intermediate zone, but wandering a good way into either extreme as prospects of food tempt it.

The specimens of 20 and 31 January and 11 February had mature testes 6×4 (2), 5×3 (1) mm.

Coracias benghalensis indica Linn. The South Indian Roller.

Specimens collected: 333-335 ♂♂ ♀ 15-1-30 Sātnur (2,500'); 450 ♂ 26-12-39 Doddallapur (2,900'), 779 ♂ 30-1-40 Settihalli (2,500'). Biligirirangan Hills: M108(G) ♂ 1-8-34 (3,000'—Udahatti, E. base)

Elsewhere noted: Hūnsur, Māndya, Nāmadachilumē, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
5 ♂ ♂	41-45	180-184	119-128.5 mm
1 ♀	41.5	174	117 mm.—H. W.]

Resident. Not common and sparsely and patchily distributed. Confined to deciduous biotope. Frequents open, lightly wooded country and cultivated areas. Curiously enough not a single example was observed between 10 November and 5 December at Bandipur, Antarsanté, Mysore City environs, Käkenköté or Karäpür although appropriate facies were not wanting.

The noisy, aerial pre-nuptial display was first observed on 15 December (Sätnür). Specimens 459 (26 January) and 779 (30 January) both had maturing testes—6×4 mm.

Major Phythian-Adams has a c/2 in his collection from Nanjangud—2-1930, and another c/2 Gündlüpet 7-4-1938.

Merops orientalis orientalis Latham. The Common Indian Bee-eater.

Specimens collected : *Biligirrangan Hills*, 41 ♀ 10-11-39 (3,500'—Bedagüli), M26(G) ♀ 12-7-34, M87(G) ♂ 25-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted : Bandipur, Antarsanté, Sätnür, Marikänié, Setthälli, Agümbe, Kolar Gold Fields, Mysore and Bangalore City environs.

[Measurements : 1 ♀ Bill 33, Wing 91.5, Tail 107 mm.

Both the July birds are in moult.—H. W.]

Resident. Common. Confined to deciduous biotope, extending partly through the dry-inter belt. Affects open scrub-and-bush and cultivated country. Also found in forest *taungya* clearings.

Merops superciliosus javanicus Horst. The Blue-tailed Bee-eater.

Specimens collected : 819 ♂, 820 ♂ 4-2-40 Ägümbe (2,500').

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
1 ♂ ad.	46.5	135	130.5 mm.
1 ♂ juv.	44.5	127	85.5 mm.—H. W.]

Status? Apparently rare. The specimens were out of a small party seen near the Travellers' Bungalow in open village outskirts on the edge of evergreen forest.

Merops leschenaulti leschenaulti Vieillot. The Chestnut-headed Bee-eater.

Specimens collected : 326 ♀ 13-12-39 Shimsha (2,500'). *Biligirrangan Hills* : 30 ♀ 9-11-39 (4,000'—Edbüthi).

Elsewhere noted : Setthälli.

[Measurements : 2 ♀ ♀ Bill 38.5, Wing 106, Tail 80-80.5 mm.—H. W.]

Status? Uncommon; occurring sparingly and sporadically. Apparently confined to deciduous biotope, principally to the dry-inter belt, but extending in small numbers throughout the intermediate zone. Affects well wooded country.

Bucia athertoni (Jardine & Selby). The Blue-bearded Bee-eater.

Specimens collected : 309 ♂ 19-12-39 Hünsür (2,000'). *Biligirrangan Hills* : M16(G) ♀ 16-10-34 (5,000'—Honnametti); M39(G) ♀ 13-9-34, M43(G) ♀ 24-9-34 (2,000'—Satyamangala).

Elsewhere noted : Manchgowdanhalli, Nämädachilumé.

[Measurements :

	Bill	Wing	Tail
1 ♂	50.5	143.5	137 mm.
2 ♀ ♀	50.57	138	128-137 mm.

One of the Biligiri specimens is in heavy moult hence not measured.—H. W.]

Resident. Uncommon and patchy. I believe this is really a bird of the dry-inter belt, but it wanders across into either of the terminal biotopes for some distance.

It affects fairly well-wooded country with a sprinkling of large trees.

Ceryle rudis subsp. The Pied Kingfisher.

No specimens.

Noted : Karāpūr (at tanks and Kabani river), Kolār Gold Fields (at Bētmangala tank and Pālār river). Not common.
Major Phythian-Adams has a c. 8, Gūndlūpē, 20-1-1929.

Alcedo atthis taprobana Kleinschmidt. The Common Ceylon Kingfisher.

Specimens collected. 327 ♂ 13-12-39 Shimsha (2,900'); 558 ♀ 7-1-40 Marikānivē (2,500'); 654 ♂ 10-1-40 Saklēshpūr (3,000'); 844 ♂ 7-2-40 Āgūmbē (2,000'); *Biligirirangans* M10(G) ♂ 8-8-34 (3,000'—Cdahatti, E. base). Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
1 ♂	44	79	39.5
3 ♀ ♀	43-44.5	72.5-73	33-33.5 mm.

While these are not quite pure *taprobana* they are certainly closer to that race than to *bengalensis*.—H. W.]

Resident. Not common. Seen singly on rivers and streams chiefly in deciduous biotope, but extending into the intermediate zone.

Ceyx erithaca erithaca (Linn.) The Indian Three-toed Kingfisher.

Specimen collected. 283 ♂ 6-12-39 Manchgowdanhalli (2,500').

Elsewhere not noted.

[Measurements. 1 ♂ Bill 36, Wing 58, Tail 24.5 mm.

A very welcome record in view of my remarks in the Eastern Ghāts Survey (J.B.N.H.S., xxxii, 761) about the paucity of records for South India. Mr. C. G. Webb-Peploe kindly informs me that about 1936 he found one of these beautiful kingfishers dead in a stream bed at 2,000' at Naraikkadu on the east slope of the Ashāmbū Hills in Travancore.—H. W.]

The specimen—the only met with in Mysore—was solitary in dense deciduous bamboo jungle on the banks of the Kabani river.

Ramphalcyon capensis [*gurjal* (Pearson)] The Brown-headed Stork-billed Kingfisher.

No specimens.

Noted : Manchgowdanhalli (deciduous biotope. On Kabani river); Settihālli. Major Phythian-Adams has a c. 3, Moyār river (Mysore-Nilgiris boundary) 31-3-38.

Halcyon smyrneensis smyrnensis (Linn.). The White-breasted Kingfisher.

Specimens collected. 341 ♂ 15-9-39 Sātnū (2,500'), *Biligirirangans Hills* M10(G) ♂ 15-9-34 (2,000'—Satyamangala), and another without precise data. Elsewhere noted : Saklēshpūr, Settihālli.

[Measurements. 1 ♂ Bill 62.5, Wing 123.5, Tail 82 mm.

In size and colour I cannot separate this from the typical race. The two birds from the Biligirirangans, however, both in complete moult, are very dark and would seem to be *fusca*.—H. W.]

Resident. Not common. Confined to deciduous biotope. Frequents tanks and ponds as well as light secondary jungle.

Halcyon pileata (Bodd). The Black-capped Kingfisher

No specimens.

A solitary example was observed on rocks in the 'cauldron' at the foot of Jōg (Gersoppa). Falls, 10-2-40.

Humayūn Abdulali (J.B.N.H.S., xxxviii, 830) noted a solitary bird in this same spot in December 1935, as curiously enough did also Davidson exactly 42 years earlier! (J.B.N.H.S., xii, 46).

Hydrocissa coronata (Bodd.). The Malabar Pied Hornbill.

No specimens.

A party of three was observed in deciduous forest with tall trees and bamboo at Manchgowdanhalli (near Antarsāntē) 3-12-39. This was the only meeting with the species in Mysore.

Tockus birostris (Scopoli). The Common Grey Hornbill.

Specimens collected: 321 ♂ 13-12-39 Sātnūr (2,500'). *Biligirirangans*: M₃ (G) ♀ 14-9-34 (2,000'—Satyamangala).

Elsewhere noted: Maddūr, Gündlūpet, Hiriyūr.

Resident. Common. Confined to deciduous biotope. Affects secondary jungle, and wooded country and groves about cultivation.

Tockus griseus (Latham). The Malabar Grey Hornbill.

Specimens collected: 642 ♂ 16-1-40 Sālkēshpūr (3,000'), 675 ♂ 19-1-40 Bābābūdan Hills (4,500—Kemmangundi).

[Measurements.]

	Bill from skull	Wing	Tail
1 ♂	100	205	210 mm.
1 ♀	84	195	204 mm.—H. W.]

Resident. Common. Confined to evergreen biotope, being the ecological counterpart here of the Common Grey Hornbill. Affects forest, especially where the various species of *Ficus* abound.

Upupa epops ceylonensis Reichenbach. The Ceylon Hoopoe.

Specimens collected: 101 ♂ 18-11-39, 155 ♂ 23-11-39 Bandipūr (2,800-3,000'), 390 ♂ 20-12-39, 472 ♂ 27-12-39 Dodballapur (2,900'); *Biligirirangan Hills*: M₄₀(H) ♂ 10-4-34 (5,000'—Honnametti); M₂(G) ♂ 14-9-34 (2,000'—Satyamangala), M₃₂(G) ♂ 14-7-34, M₈₉(G) ♂ 25-7-34 (3,000'—Udahatti, E. base). Elsewhere noted: Hiriyūr, Kolar Gold Fields.

[Measurements.]

	Bill	Wing	Tail
6 ♂ ♂	52-61.5	120 5-143	83-98 mm.
2 ♀ ♀	51-55.5	127	84-88 mm.—H. W.]

Resident. Not common. Confined to deciduous biotope but extending in diminishing numbers through the intermediate zone up to its evergreen boundary. The December males had maturing testes: 7×4 and 5×3 respectively.

Harpactes fasciatus malabaricus (Gould). The Malabar Tropic.

Specimens collected: 612 ♀ 13-1-40 Sālkēshpūr (3,000'); 741 ♀ 26-1-40, 767-768 ♂ ♀ 29-1-40, 788 ♂ 31-1-40 Settihalli (2,500').

[Measurements:]

	Bill	Wing	Tail
2 ♂ ♂	20-20.5	123.5-128	150-162 mm.
3 ♀ ♀	20-21	122.5-127	162-167 mm.—H. W.]

Resident. Fairly common. Confined to evergreen biotope, extending across the moist-inter zone.

Micropus melba bakeri (Hartert). The Indian Alpine Swift.

Specimens collected: 532 ♀ 3-1-40 Devarāyadrūg (4,000'—Tūmkūr Dist.); 857 ♀ 11-2-40, 861-864 ♂ ♂ ♂ ♀ 12-2-40, also ♂ ♀ 25-12-35 (Humayun Abdulali), Jōg (2,000'—Sāgar Dist.). *Biligirirangan Hills*: o? 19-12-32 (5,000'—above Dodsāmpagi).

Elsewhere noted: Bandipūr, Nandidrūg.

[Measurements:]

	Bill	Wing	C. tail	O. tail
4 ♂ ♂	14-16	204-212	59-62.5	74-77 mm.
5 ♀ ♀	14-15.5	200-206	58-61	72-76 mm.

A very useful contribution to the verification of this interesting race distinguished both by its small size and by its dark colouration.—H. W.]

Resident and local migrant. Not common. Usually seen in the hills hawking winged insects about and above fissured crags and rock scars.

On the summit of Devārayadṛiṇi Hill I observed that the birds circled back and forth almost within gunshot before the sun had set, but that they steadily rose higher and higher after the sun went down. This was evidently due to the fact that their insect prey kept rising higher to remain in the warmth of the sunlight. The birds were usually seen flying about the hill until about 10-30 a.m. when some of them at least retired into the fissures of the rock (brooding?). Thereafter practically none were on the wing in this neighbourhood again before late afternoon, and they continued to feed till well after dusk high up in the heavens.

Several pairs were observed in copula on the wing, the male treading the female in mid-air. During the act both birds whirled round and round as one unit and fell slowly through space parachute-wise for about 100 feet or so on outstretched but motionless wings. They separated after this and flew off individually.

All the specimens had maturing or fully mature gonads, and breeding was undoubtedly in progress. Testes 9×4 to 14×6 mm., ovaries markedly granular. The largest follicle in No. 532 (3 January) measured 4 mm. and its distended oviduct indicated that it had laid.

Humayun Abdulali collected breeding birds at Jōg, where the species is particularly numerous, on 26-12-35 (J.B.N.H.S., xxviii, p. 829). Strangely enough when Mr. C. McCann visited the falls on 10 June (1938) he found these Swifts completely absent (J.B.N.H.S., xli, p. 450). Where they go away during the S.-W. Monsoon still remains to be discovered. Humayun Abdulali tells me that the birds were absent from this locality on 3 August (1939), but some were back by 7 September when the place was revisited by him.

Micropus affinis [affinis] (Gray) The Common Indian House-Swift.

No specimens.

Resident. Confined to deciduous biotope. Evidently not common. Small numbers of these swifts were observed about Vanivilās Dam at Marikānivē (9 January). Also about the old temples at Halebid (12 January) wherein they were nesting and making a nuisance of themselves. Several disused nests were also seen in the former locality.

***Chaetura giganteus indicus* Hume.** The Brown-throated Spinetail.

No specimens.

Noted: Maddūr (near Gündlūpet), Sakleshpūr, Bābābūdān Hills (Jāgar Valley).

Presumably resident. Confined to evergreen biotope. Usually seen in loose flocks flying at terrific speed and hawking insects over grassy hilltops and forest clearings, especially where fired.

***Indicapus sylvaticus* (Blyth).** The White-rumped Spinetail.

No specimens.

Noted: Sakleshpūr, Kādāmānē Estate, Settihalli.

Resident? Sporadic. Confined to evergreen biotope. Like the preceding species it is usually seen in loose 'flocks' hawking insects above grassy hilltops and forest clearings; frequently also in the intermediate zone.

***Collocalia fuciphaga* subsp.** The Edible Swiftlet.

No specimens.

Noted: Karāpūr (Deciduous). A gathering of 30-50 birds hawking insects high above Kabani river, 3-12-39. Agūmbē: (Evergreen. A few on 2-2-40!).

***Hemiprocne coronata* (Tickell).** The Indian Crested Swift.

Specimens collected: 120 ♂, 121 ♂ 20-11-39 Bandipūr (3,300').

Elsewhere noted: Shimsha, Sivāsamūdram, Nāmadachilumē, Settihalli.

[Measurements: 2 ♂♂ Bills damaged. Wing 153-154, C. Tail 44, O. Tail 109.5-117 mm.—H. W.]

Resident. Not uncommon. Confined to deciduous biotope. Met with in secondary jungle and about forest clearings for cultivation.

Caprimulgus macrourus atripennis Jerdon. Jerdon's Long-tailed Nightjar.

Specimen collected: 147 ♂ 23-11-39 Bandipūr (3,300').

[Measurements: 1 ♂ Bill 23.5, Wing 189, Tail 133 mm.—H. W.]

The specimen was hawking beetles at dusk on a motor road through deciduous and bamboo forest.

Caprimulgus indicus indicus Latham The Indian Jungle Nightjar.

Specimens collected: 119 ♀ 20-11-39 Bandipūr (3,300'); 249 ♀ 3-12-39 Antarsāntē (2,500'); 627 ♂ 14-1-40 Sakleshpūr (3,000'); 747 ♂, 748 ♂ 27-1-40 Settihālli (2,500'). *Biligirirangan Hills*: M13(H) ♀, M16(H) ♂ 4-3-34 (5,000'—Honnametti).

[Measurements.]

	Bill	Wing	Tail
4 ♂ ♂	20-23.5	192-198	129.5-137 mm.
4 ♀ ♀	23-24.5	190-195	129-131 mm.—H. W.]

Resident? Common. Confined to deciduous biotope; occasionally found in the dry-inter belt. Affects teak plantations and bamboo facies. Perches on branches both lengthwise and across. No. 627 was shot at 10 a.m. perched lengthwise asleep on a branch of a tall shade tree at edge of coffee plantation.

The call of this nightjar, commencing at dusk and continued far into and often throughout the night, (especially if moonlit) is *Krük . . . krük-kroo* or *Uk . . . krük-kroo* repeated monotonously every 2 seconds or so for $\frac{1}{4}$ or even $\frac{1}{2}$ hour at a stretch. Elsewhere I have recorded the call also as *Chuck-ko, chuck-ko* etc about once every second.

Caprimulgus monticulus monticulus Franklin Franklin's Nightjar.

Specimens collected: 134 ♀ 21-11-39 Gūdalūr Ghāt (3,000'—near Kākenhālla), 148 ♀ 23-11-39 Bandipūr (3,300').

[Measurements: 2 ♀ ♀ Bill 19-20, Wing 187-190, Tail 108-113.5 mm.—H. W.]

Usually seen on roads through deciduous forest at dusk. No. 134 was perched on a telegraph wire (across).

Caprimulgus asiaticus asiaticus Latham The Common Indian Nightjar.

Specimens collected: 231 ♂ 2-12-39 Autusāntē (2,500'), *Biligirirangan*. M113(G) ♀ 4-8-34 (3,000'—Udahātī, E. base). Elsewhere noted: Marikānivē.

[Measurements:]

	Bill	Wing	Tail
1 ♂	19	143	— mm.
1 ♀	—	147	103 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects open sparse scrub-and-bush country and fallow land.

Testes of 2 December specimen 7×5 mm.

Asio flammeus flammeus (Pontoppidan). The Short-eared Owl.

Specimens collected: 655-658 ♀ ♀ ♀ ♀ 17-1-40 Hebbalē, Coorg (2,500').

[Measurements: 4 ♀ ♀ Bill 30-30.5, Wing 300-318, Tail 143.5-146 mm.—H. W.]

These specimens were obtained actually a few miles beyond the western boundary of Mysore State, but are included here since there seems no reason to doubt that the species also occurs within our area in the appropriate deciduous facies.

The birds were shot from a loose 'flock' of about 20 resting amongst scrub and grass covered stony hillocks. One was observed sunning itself, belly to ground and wings outstretched. On the wing, and seen from behind, the birds were reminiscent of a party of Houbara bustards.

At 3 o'clock in the afternoon, when shot, the stomachs of all the specimens were quite empty.]

Strix indracea indracea Sykes. The Brown Wood-Owl.

Specimens collected: 168 ♂ 25-11-39 Bandipur (3,300').
Elsewhere noted: Sätnur.

[Measurements. 1 ♂ Bill 40, Wing 340, Tail 186 mm.—H. W.]

The specimen was one of a pair up in a dense bamboo clump in deciduous forest. Its stomach was empty at 7-30 a.m., when shot, but for a single live *Ascaris*-like nematode worm *Seuratatum* sp., probably a 'pseudoparasite.' Testes 13×7 mm.

Strix ocellata (Lesson). The Mottled Wood-Owl.

Specimens collected: 135 ♀ 22-11-39 Bandipur (2,800'—near Hangala village).
Elsewhere noted: Chamarājanagar, Gündlupet, Marikānivē.

[Measurements. 1 ♀ Bill 40.5, Wing 339, Tail 177 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects wooded country with large densely folaged tamarind and similar trees around villages and cultivation. When flushed from its daytime retreat it can fly long distances in bright sunshine without apparent discomfort. As distinct from *Bubo*, this owl alights on the inside (more or less secluded) branches of a tree after a flight, and not on the outside or peripheral ones.

Bubo bubo bengalensis (Franklin). The Indian Great Horned Owl.

Specimens collected: 136 ♂ 22-11-39 Bandipur (2,800'—near Hangala village); 537 ♂ 4-1-40 Nāmadachilumē (3,000').

[Measurements. 2 ♂♂ Bill 44-47, Wing 364-374, Tail 190 mm.]

These specimens are rather dark on the upper plumage, but I have already pointed out (*J.B.N.H.S.*, xxxviii, 234) that this species is very variable in colour and I do not think that northern and southern races should be separated.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects ravines and boulder hillocks in secondary forest and sparsely wooded country, as well as groves of large thickly foliated trees in the neighbourhood of villages and cultivation.

The specimens were both either breeding or about to breed. testes 18×10 and 15×10 mm. Under the skin of the nape of No. 136 were found embedded several examples of the Nematode worm *Parhamatospiculum bubicola* Skrjabin & Petrow, 1935.

A local belief current about the large owls was narrated to me by a Forest Range Officer. It appears that if a large owl (species not stated) is confined without food for 8 days and thereafter well beaten with a stick, it begins to talk fluently like a human (language unspecified!) and can be made to tell your fortune with infallible precision. Here is a tip for those waiting for ships to come home!

Ketupa zeylonensis leschenaulti (Temminck) The Brown Fish-Owl.

Specimens collected: ♀ Biligirirangan Hills (without precise data).
[Measurements: 1 ♀ Bill 51, Wing 402, Tail 200 mm.—H. W.]

Noted: Antarsāntē (29-11-39 A pair by forest tank at dusk).

Probably not uncommon in suitable localities—about tanks and streams.

Otus bakkamoena sub-sp. The Scops Owl.

No specimens.

The characteristic call of this little owl 'Wüt . . . wüt' &c was heard after dusk at Nāmadachilumē and Settihālli, 1 and 30 January. Evidently somewhat uncommon.

Athene brama brama (Tennm.) The Southern Spotted Owlet.

Specimens collected: 137 ♂ 22-11-39 Bandipur (2,800'—Hangala village); 272 ♂ 5-12-39 Antarsāntē (2,500'); 386 ♀ 19-12-39 Mäklidrūg (2,800'); 395 ♀ 20-12-39, 461 ♀ 26-12-39 Dodballapūr (2,900'). Biligirirangan Hills: M28(G) ♀ 13-7-34 (3,000'—Udahatti M30(G) ♂ 21-9-34 (2,000'—Satyamangala). Elsewhere noted: Chamarājanagar.

[Measurements :

	Bill	Wing	Tail
3 ♂ ♂	19.5-20	148-156	68-73 mm.
4 ♀ ♀	20.5-21	152.5-154	69-72.5 mm.

All are dark birds.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects groves of large trees in the neighbourhood of towns, villages and cultivation.

No. 272 (5 December) was very fat.

Glaucidium radiatum radiatum (Tickell) The Malabar Jungle Owlet.

Specimens collected: 173 ♀, 174 ♀, 175 ♂ 25-11-39 Bandipūr (3,000'—near Käkenhälla); 210 ♀, 211 ♂ 30-11-39 Manchgowdānhalli (2,500'); *Biligirirangan Hills*: M1(H) ♂ 10-3-34 (4,000'); M15(G) ♂ 15-9-34 (2,000'—Satyamangala), M34(G) ♂ 22-10-34 (5,000'—Honnametti).

[Measurements :

	Bill	Wing	Tail
5 ♂ ♂	17.5-19	130-133	68.5-76.5 mm.
3 ♀ ♀	16-18.5	129.5-133.5	66-70.5 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope, occasionally entering the dry-inter belt. Its typical habitat is teak and bamboo forest.

The stomach of one example contained a grasshopper and the viscera of a snail.

Ninox scutulata hirsuta Temm. The South Indian Hawk-Owl.

Specimen collected: 736 ♀ 26-1-40 Setthälli (2,500').

Elsewhere noted. Edbūthi (4,500'—Biligirirangans).

[Measurements: 1 ♀ Bill 22, Wing 212.5, Tail 121.5 mm.—H. W.]

The specimen was shot off the roof of the Forest Lodge after dark. Two or three other birds were heard calling in the deciduous bamboo forest in this neighbourhood. The call of this owl is a distinctive, rather pleasant, *Oo...ük, oo...ük* etc. repeated once a second and 4 to 10 times running. A pause of half to one minute follows and then the calls are repeated.

The ovary of the specimen was maturing; largest follicles over 2 mm. A tangle of 13 round thread-like Nematode worms (*Farhamatospiculum* sp. (Fam. Filaridae)), from 25 to 80 mm. long (mostly over 50 mm.), were removed from under the skin of the skull above one eye-socket. Otherwise the bird seemed perfectly healthy. Its stomach (at 8 p.m.) was crammed with remains of what were apparently Potter Wasps (*Eumenes*)—orange brown in colour.

Pandion haliaetus haliaetus (Linn.) The Osprey.

Specimen collected: 287 ♂ 8-12-39 Seringapatām (Palahally Island, Cauvery, 2,000').

Elsewhere noted Marikānivē (Solo on Vanivilās Sāgar 7 Jan.).

[Measurements: 1 ♂ Bill 41.5, Wing 481, Tail 210 mm. H. W.]

Winter visitor. Scarce.

Sarcogyps calvus (Scop.). The Black or Pondicherry Vulture.

No specimens.

Noted. Bandipūr, Marikānivē.

Occasional solos.

Gyps fulvus fulvescens Hume. The Indian Griffon Vulture.

No specimens.

Noted (unconfirmed) at Jōg where several pairs were nesting on ledges of rock scarp a few hundred yards downstream from the Gersoppa Falls (10 February).

Gyps indicus [indicus] (Scop.) The Long-billed Vulture.

Humayun Abdulali records a few pairs nesting on cliffs opposite Jōg Falls at end December 1935. (J.B.N.H.S., xxxviii, 830).

Pseudogyps bengalensis (Gmelin). The Indian White-backed Vulture.

No specimens.

Noted: Settihälli, Jög and elsewhere.

A single nest with bird brooding was observed on a tall straight tree ca. 60 ft. up, in forest of moist-inter facies at Settihälli. No other nests were in the proximity, but the birds were here numerous, and it was evident from the acid reek of their droppings and the dirty whitewashed appearance of the ground that they roosted in the adjoining area at night.

At Jög a number of nests with birds either brooding or perched in their proximity were observed on tall upright trees in evergreen forest. (10-2-40).

Neophron percnopterus ginginianus (Latham). The Smaller White Scavenger Vulture.

No specimens.

Noted: Biligirirangan Hills (about cattle sheds and coolie lines on coffee estates); Bandipūr, Sātnur, Chitaldrūg, Mysore, Bangalore, Dodballapūr, Kolār Gold Fields and elsewhere.

Resident. Common. Confined to deciduous biotope. Occasionally met with in the intermediate zone around human habitations.

On 9 January a bird was observed carrying building material, and nesting was in progress on the bare rocky hills in the environs of Chitaldrūg town.

Major E. G. Phythian-Adams has one egg each from 2 nests at Nanjangūd, 2-2-1939.

Falco peregrinus peregrinator Sundevall. The Shahīn Falcon.

No specimens.

Noted: Balmoorie Island (Cauvery river, near Krishnārājsāgar); Devārāya-drūg (3,500'-Tümkūr Dist.); Bābābūdan Hills (5,000'-above Kemmangūndi); Jög (on cliffs flanking Gersoppa Falls).

Solitaires or a pair were seen about cliffs and rock scarps in the hills. On 22 January a pair had their nest on an inaccessible ledge of rock in the Bābābūdan (ca. 5,000' elevation). The owners were observed playfully stooping about the cliffs at incredible speed, and performing a variety of amazing aerobatics.

Falco tinnunculus tinnunculus Linn. The European Kestrel.

Specimens collected: 144 ♀ 22-11-39 Bandipūr (3,300'); 337 ♂ 15-12-39 Sātnur (2,500'), 396 ♂ 20-12-39 Dodballapūr (2,900'), Biligirirangan Hills. M35(G) ♀ 22-10-34 (5,000'-Honnametti).

[Measurements:

	Bill	Wing	Tail
2 ♂ ♂	21-22	234-253	161-166 mm.
2 ♀ ♀	21.5-22	249-255	163-170 mm.—H. W.]

Falco tinnunculus objurgatus (Stuart Baker). The Indian Kestrel.

Specimens collected: 841 ♀ 7-2-40 Āgūmbē (2,000'). Biligirirangans: 6 ♂ 6-11-39 M40(G) ♀ 22-10-34 (5,000'-Honnametti) also 1 without precise data.

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	21.5-22	222-232	145-158 mm.
2 ♀ ♀	22-22.5	242.5-253	164-175 mm.—H. W.]

Tinnunculus winter visitor; *objurgatus* resident.

Usually seen singly about grassy hillslopes and in bare open sparsely scrubbed country and fallow land, mostly in deciduous biotope.

Aquila rapax vindhiana Franklin. The Indian Tawny Eagle.

No specimens.

Noted only at Marikānivē 7-1-40. Evidently rare.

Lophotriorchis kleneri (de Sparre). The Rufous-bellied Hawk-Eagle.

No specimens.

Noted: Settihälli (2,500'-Shimōga Dist.). A solitary bird perched bolt upright in a lofty bare tree on edge of forest clearing for teak plantation; moist-inter belt.

Ictinaetus malayensis perniger (Hodgs.). The Indian Black Eagle.

No specimens.

Noted : Biligirirangan Hills 5,000'. Solo 19-12-32.

Circaetus ferox (Gmelin). The Short-toed Eagle.

Specimen collected : 154 ♀ 23-11-39 Gopālaswāmi Betta (4,800'—near Gündlū-pet).

Elsewhere noted : Birūr (Solo in dry scrub-and-bush country about cultivation).

[Measurements : 1 ♀ Bill 53.5, Wing 525, Tail 278 mm.]

This specimen is considerably darker above and has the markings on the lower surface both heavier and darker than in my series of North Indian birds. Unfortunately there are no other South Indian birds available for comparison—except 2 unsexed skins marked vaguely 'Madras' in the British Museum—so it remains to be ascertained whether there is a dark southern race or whether the difference is due to individual variation. This eagle varies a certain amount in plumage.—H. W.]

Resident. Apparently confined to deciduous biotope. The specimen was ready to breed. Largest ovum 6 mm. Its stomach contained a snake (*Psammophis condanarus*) 9" long, and loose snake scales. Strangely enough this is the first record of this snake from Mysore.

Haematornis cheela melanotis (Jerdon). The Crested Serpent-Eagle.

Specimens collected : 724 ♀ 23-1-40 Bābābūdan Hills (3,500'—below Kemman-gundi); 816 ♀ 2-2-40 Settihälli (2,500').

Elsewhere noted : Heggadadevankotē, Nāmadachilumē.

[Measurements :

	Bill	Wing	Tail
No. 724 ♀	46.5	497	294 mm.
No. 816 ♀	43.5	424	260 mm.

No. 816 is a perfectly typical example of *melanotis* in both size and colour. No. 724 on the other hand would pass both in size and colour as a specimen of *H. c. cheela*. One can either consider it therefore as a vagrant wanderer of the typical race which has somehow reached South India, or as an aberrant specimen of the race *melanotis* varying towards the typical race. I prefer the latter explanation for I have already pointed out (*J.B.N.H.S.*, xxxviii, 426-427) how very variable this eagle is.—H. W.]

Resident. Affects heavy forest both in evergreen biotope and in the intermediate zone.

The ovary of No. 724 (23 Jan.) was maturing with many of the follicles over 2 mm. in diameter. It was very fat. Its stomach contained snake scales.

The call of this eagle is distinctive and usually the first indication of its presence in any locality. It is a shrill *kek-kek-kek-kek-kek-kek-kēe*—the final note prolonged and particularly shrill. This call is mostly uttered on the wing.

Butastur teesa (Franklin). The White-eyed Buzzard-Eagle.

Specimens collected : 138 ♀ 22-11-39 Bandipūr (2,800'—near Hangala village); 199 ♀ 29-11-39 Antarsāntē (2,500').

Elsewhere noted : Settihälli.

[Measurements :

	Bill	Wing	Tail
1 ♀ ad.	32	309	183 mm.
1 ♀ imm.	31	278	158 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects open light secondary jungle and the vicinity of cultivation.

Haliastur indus indus (Boddaert). The Brahminy Kite.

Specimen collected : Biligirirangan Hills : M103(G) ♀ 29-7-34 (3,000'—Udahatti).

Elsewhere noted : Antarsāntē, Jōg, Kolār Gold Fields, Sātnūr,

Resident. Fairly common. Confined to deciduous biotope near tanks and rivers, but met with temporarily elsewhere in search of food. On 10 February a solitary example was observed flying up and down the Gersoppa Falls, sticking to the contours of the flanking crags, using the wind eddies to rise effortlessly without wing beats to the head of the falls. After circling round here in among the spray a couple of times the bird shot down (also along the contours) at great speed almost to the foot of the falls, with wings half pulled in like a Peregrine stooping. The entire performance was repeated again and again, its object remaining a mystery.

At Antarsāntē a nest was observed, with bird brooding, in the top of a large peepal tree growing in the village (5 December).

Milvus migrans govinda Sykes. The Common Pariah Kite.

Specimen collected: 145 ♂ 23-11-39 Bandipūr (3,300').

Elsewhere noted: Chamarājanagar, French Rocks, Mysore, Bangalore, Thōndēbhāvi, Marikānivē. Almost ubiquitous.

[Measurements: 1 ♂ Bill 38, Wing 452, C. Tail 221, Outer Tail 284 mm.—H. W.]

Resident. Preferentially in deciduous biotope, but small numbers also in the moist-inter belt around human habitations in the low country, and ascending temporarily in search of food to the highest homesteads in the hills. All the time from 4 November to 6 January the breeding season was in progress. Many pairs were observed in copula and numerous nests with birds brooding or under construction were observed.

The testes of the specimen measured 17×6 mm.

Elanus caeruleus vociferus (Latham). The Black-winged Kite.

Specimens collected: 75 ♀ 15-11-39 Bandipūr (3,300'); *Biligirirangans* : M107 (G) ♂ 1-8-34 (3,000'—Udahatti, Eastern base).

[Measurements :

	Bill	Wing	Tail
1 ♂	23	—	122 mm.
1 ♀	24	269	119 mm.—H. W.]

Resident (presumably). Uncommon Confined to deciduous biotope. Affects secondary and scrub jungle.

Circus macrourus (S. G. Gmelin). The Pale Harrier.

Specimen collected: 129 ♂ 20-11-39 Bandipūr (3,300').

[Measurements: 1 ♂ ad. Bill 26.5, Wing 345, Tail 213 mm.—H. W.]

Winter visitor. Not common.

Stomach of the specimen contained remains of a lizard, and a quail chick about 1 day old.

Circus aeruginosus aeruginosus (Linn.). The Marsh Harrier.

No specimens.

Noted: Saklēshpūr (solo at swamp 15-1-40); Kolār Gold Fields (Bētmangala tank 22-2-40).

Winter visitor. Not common.

Astur badius dussumieri Temm. & Laug. The Indian Shikra.

Specimens collected: 288 ♀ 8-12-39 Seringapatām (2,000'—Palahally Island, Cauvery river); 336 ♀ 15-12-39 Sātnūr (2,500'); 468 ♂ 27-12-39 Dodballapūr (2,000'); 507 ♂ 29-12-39 Thōndēbhāvi (2,500'); 515 ♂ 1-1-40 Devārāyadūr (3,500'); 756 ♂, 757 ♂ 28-1-40, 805 ♀ 2-2-40 Settihālli (2,500'); *Biligirirangan Hills* : M40(G) ♂ 23-9-34 (2,000'—Satyamangala).

[Measurements :

	Bill	Wing	Tail
3 ♂ ♂ ad.	20-21.5	176-192.5	133-147 mm.
1 ♀ ad.	23	201	160 mm.
3 ♀ ♀ imm.	21.5-22	193-200	150-165 mm,

In the Eastern Ghāts Survey (J.B.N.H.S., xxxviii, 432) I discussed the question of the races of this species at some length, and this fine series merely strengthens the views that I arrived at then.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects wooded country and groves frequently in the neighbourhood of villages and cultivation.

No 288 (8 December) was the only one of the Survey specimens that showed any gonadal development: ovarian follicles 2 mm. It was very fat. It dashed out of its ambush after a Rosy Pastor. No. 805 had all the primaries and some secondaries of one wing, and also the tip of its tail singed for about half their length. Presumably this was caused accidentally while hunting in a fired grass and scrub patch (*taungya* clearing).

Accipiter virgatus besra Jerdon. The Southern Besra Sparrow-Hawk.

Specimens collected: *Biligirirangan Hills*: 35 ♀ 10-11-39 (4,000'—Bedagūli); M25(H) ♂ 30-3-34 (5,000'—Honnametti).

[Measurements:

	Bill	Wing	Tail
1 ♂ imm.	18	155	127 mm.
1 ♀ ad.	22	183.5	142 mm.—H. W.]

Resident. Shot in the moist-inter belt. The stomach of 288 contained remains of a Green Barbet (*Thereiceryx viridis*).

Pernis ptilorhynchus ruficollis Lesson. The Indian Crested Honey-Buzzard.

Specimens collected: 189 ♀ 28-11-39, 269 ♂ 5-12-39 Antarsāntē (2,500'); 252 ♂ 3-12-39 Karāpūr (2,500').

Elsewhere noted: Biligirirangan Hills 4,000-5,800'.

[Measurements:

	Bill	Wing	Tail
2 ♂♂ ad.	41-41.5	412-417	252-259 mm.
1 ♀ imm.	40	403	262 mm.—H. W.]

Resident. Fairly common. Particularly plentiful in the neighbourhood of Antarsāntē. The stomachs, crops and gullets of the specimens were crammed with wax and honey, and in one instance also some small bees (species?).

No. 189 was very fat. 269 (5 Decr.) had maturing testes—17×6 mm. When incised for removal of tendons, it was noticed that all its 8 toes were infested under the skin with Nematode worms (*Pelecitus* sp.), especially at the base of the claws.

Crocosoma phoenicopterus chlorogaster (Blyth). The Southern Green Pigeon.

Specimens collected: 195 ♂ 29-11-39, 268 ♂ 5-12-39 Antarsāntē (2,500'). *Biligirirangan Hills*: M24(H) ♀ 18-3-34, M72(G) ♂ 22-7-34, M97(G) ♂ 27-7-34 (3,000'—Udahatti Eastern base).

[Measurements:

	Bill	Wing	Tail
4 ♂♂	21-23	185-192	116-118 mm.
1 ♀	24	184	— mm.—H. W.]

Resident, but locally migratory (especially altitudinal) depending upon the ripening of the various fruits that comprise their food. Fruits ripen later on the hills than in the plains.

This Green Pigeon is essentially a bird of deciduous biotope but it also occurs freely in the dry-inter belt.

At Bandipūr their food consisted largely of *Ficus* figs and gall-nuts (myrabolans).

Dendrophassa pompadoura affinis (Jerdon). The Grey-fronted Green Pigeon.

Specimens collected: 803 ♂ 1-2-40 Settihālli (2,500'); 818 ♀ 4-2-40 Agūmbē (2,500') 871 ♂ 12-2-40 Jōg (2,000').

Elsewhere noted: Bābābūdan Hills 3,000-4,500'.

[Measurements :

	Bill	Wing	Tail
2 ♂♂	18.5-20	141.5-142.5	85 mm.
1 ♀	19	149.5	84 mm.—H. W.]

Resident. Fairly common. Locally migratory as above. Confined to evergreen biotope; also found in the moist-inter belt. Affects shade trees (*Ficus* and others) in and about coffee plantations. Its call notes are like *Crocopus*, but somewhat shriller. I was informed by Mr. H. H. English, a coffee planter in the Bābābūdāns, that on his estate these pigeons frequently dash into the walls of out-houses and get killed. I have recorded a similar case under the Bronze-winged Dove in the Travancore-Cochin Survey (*J.B.N.H.S.*, xxxix, 339).

***Ducula badia cuprea* (Jerdon).** Jerdon's Imperial Pigeon.

Specimens collected : *Biligirirangan Hills* : 9 ♀ 7-11-39 (4,000'—Edbūthi); M₄₇(H) ♀ 9-4-34 (5,000'—Honnametti). Elsewhere noted : Sakleshpūr, Settihālli, Āgūmbē.

[Measurements : 2 ♀ ♀ Bill 30-30.5, Wing 227-231, Tail 166 mm.—H. W.]

Resident. Fairly common. Confined to evergreen biotope. Extends into the moist-inter belt. Met with in twos and threes on tall thinly foliated trees. Call a deep, rather mournful *Ok-ook...ook* etc. uttered with tail slightly depressed, back arched and head lowered. The flight is attained by leisurely wing beats as in the House-Crow.

The specimen of 7 November had a mature ovary with the largest follicle over 6 mm. in diameter.

***Muscadivora aenea pusilla* (Blyth).** The Ceylon Green Imperial Pigeon.

Specimen collected : *Biligirirangan Hills* : M₂₇(G) ♀ 21-9-34 (2,000'—Satyamangala).

Elsewhere noted : Antarsāntē.

[Measurements : 1 ♀ Bill 27.5, Wing 216, Tail 138 mm.—H. W.]

Resident. Uncommon. Confined to deciduous biotope, extending diminishingly into the intermediate zone. Affects secondary jungle dotted with large *Ficus* trees.

***Chalcophaps indica indica* (Linn.)** The Bronze-winged Dove.

Specimen collected : *Biligirirangan Hills* : M₃₇(G) ♀ juv. 23-10-34 (4,000'—Bellaji).

Elsewhere noted Bābābūdan Hills (4,500'—Kemmangūndi); Settihālli.

Resident. Uncommon. Confined to evergreen biotope; partial to the moist-inter belt. It also extends to the more deciduous but well wooded portions of the intermediate zone. Frequents thick secondary forest and bamboo patches, and outskirts of forest clearings.

***Columba livia* subsp.** The Blue Rock-Pigeon.

No specimens.

Noted : Bhadrāvati, Jōg.

Resident. Patchily distributed and nowhere abundant except at Jōg (Gersoppa Falls). At the Mysore Iron Works, Bhadrāvati, I noticed (24 Jan.) that while the casting was in progress (8 p.m.) a number of pigeons roosted complacently on the cross beams and rafters of the corrugated casting-shed roof, regardless of the terrific heat, glare and spluttering 'fireworks' from the molten metal, and only a few feet above the sparks from the gigantic blast furnace!

About the scarps of Gersoppa Falls the number of these pigeons has to be seen to be believed. They are there literally in thousands and when flying to and fro across the rock faces, as they do all day long in vast flocks, the birds look like swarms of midges by comparison with their surroundings.

There is a very widely current legend about the storing of grain by 'birds' obviously meaning these pigeons, in the holes and fissures of the rock behind and on the flanks of the actual waterfall at Gersoppa. This legend even had the distinction of figuring in a local political speech recently (Bangalore, 17-1-40) but what its exact significance was in the context is not understood. It is

said that the birds hoard—or at least used to hoard in by gone days—paddy in such quantities that the right of collecting this grain was formerly auctioned out by the Bombay Government for as much as Rs. 500 annually. 20 candies (140 cwt.) or more are alleged to have been recovered at a time by a man lowered in a basket. Since the accident which terminated the career of this intrepid exploiter, no one else has ventured to tap the 'granaries'. Needless to say there seems to be no one living at the moment who has any first hand knowledge of the matter. Enquiries in the relative Mamlatdar's office, kindly made for me by the Divisional Forest Officer of Karwar, revealed that all records over 50 years old have been destroyed and the entries of revenue from the auction of the garnering rights cannot now be traced.

It has not been explained how the pigeons could have transported such vast quantities of paddy to the granaries, and from where—since at the present time, at any rate, there is no extensive paddy cultivation, such as is implied, within many miles of the Falls. Of course, the legend will not bear scrutiny, but it would be interesting to learn how it originated and managed to gain such wide and ready credence.

***Columba elphinstonii* (Sykes).** The Nilgiri Wood-Pigeon.

Specimens collected: *Biligirirangan Hills*: M₄₃(H) ♀ 7-4-34 (4,000'—Bellājī); M₄₈(H) ♀ 9-4-34, M₃₆(H) ♀ 10-5-34 (4,000-5,000'—Honnametti); M₁₁₆(H) ♂? 25-5-34 (4,000'—Edbūthī).

Elsewhere noted: Devarbetta Hill (3,000'); Bābābūdān Hills (4,500'—Kem-mangundi).

[Measurements: 3 ♀ ♀ Bill 27-28, Wing 199-205 mm.—H. W.]

Resident. Fairly common but not abundant. Confined to evergreen biotope and partial to the moist-inter belt. Seen singly or in pairs, occasionally small parties, on trees in fruit.

***Streptopelia orientalis erythrocephala* (Bonaparte).¹** The Indian Rufous Turtle Dove.

Specimens collected: 792 ♀, 793 ♀ 31-1-40 Settihälli (2,500').

[Measurements: 2 ♀ ♀ Bill from feathers 16, Wing 176-178, Tail 118-120 mm.

The sight of these two skins has given me as much pleasure as any birds in the Survey, for at last Mr. Sālim Ali has produced specimens of the Rufous Turtle Dove which breeds in Peninsular India, a bird whose very existence I was almost beginning to doubt. Curiously enough about the same time I received a third specimen from the collection of the late Mr. E. A. D'Abreu², a female (one of a pair) collected at Mahrājbāgh, Nāgpūr, on 8 June 1938. In the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxviii, pp. 677-678) I discussed the whole question of these doves, but in the absence of satisfactory proof of the breeding of any form in peninsular India my conclusions were not altogether satisfactory. I am now satisfied that my 'richly coloured form' of that account falls into two races. The bird of the Eastern Himalayas and Assam is really an intermediate between *S. o. orientalis* (Manchuria, Korea, Japan and Tibet) *S. o. meena* (Western Himalayas) and the breeding bird of peninsular India which is distinguished by the vinous-red crown, nape and mantle and the deeper red of the edges of the scapulars, coverts and tertaries. The vinous-red of the undersurface is also much richer.

For the East Himalayan intermediate I propose to retain, as in my previous note, the name of *Columba agricola* Tickell, *J.A.S.B.* vol. ii (Nov. 1833) p. 581—jungles of Dholbhum and Borabhūm. The description is a poor one but obviously refers to some form of Turtle Dove. There are no specimens available from these 2 localities, but Beavan obtained specimens at Manbhūm, now in the British Museum, and these agree with East Himalayan birds.

¹ Since this is the resurrection of an old existing name, Koelz's *sylvicola* (type locality: Castle Rock, *Proc. of the Biol. Society of Washington*, vol. lii, pp. 61-82 [5 June 1939]) becomes a synonym of it.

² It may be convenient to record the fact that Mr. D'Abreu's private collection of birds from Kumaon, Sikkim, Bihar and the Central Provinces has been very generously presented to me by his son and is now being incorporated in my own collection. The labelling of these birds is a model to collectors.—H. W.

Specimens from Raipur, Seoni and North Kanara in the British Museum evidently belong to the same very richly coloured resident form as these Survey birds. For them I propose to use the name *Turtur erythrocephalus* Bonaparte, *Consp. Gen. Av.* vol. ii (after April 15, 1855) p. 60 of which the type labelled 'Cape of Good Hope' is in the British Museum. The type locality is of course an error.—H. W.

The specimens were shot on a cart road through forest in bamboo facies of the dry-inter belt. A number of other examples were observed and the species seemed to be fairly common in this locality.

No. 792 had a soft ovarian egg 17 mm. in diameter, and the distended oviduct indicated that she had laid. The ovary of 793 was mature: largest follicle 6 mm.

Streptopelia chinensis suratensis (Gmelin). The Indian Spotted Dove.

Specimens collected: 533 ♂, 534 ♂ 3-1-40 Nāmadachilumē (3,000'); 804 ♂ 2-2-40 Settihälli (2,500'); M₁₃(G) ♂ 9-7-34 (3,000'—Udahatti, Eastern base) Elsewhere noted: Bandipūr, Begūr, Sātnūr, Saklēshpūr.

[Measurements: 4 ♂♂ Bill 18-19.5, Wing 135-145.5, Tail 118-134 mm.—H. W.]

Resident. Common. Confined to deciduous biotope, extending into the dry-inter belt. Frequents wooded country around cultivation etc.

All the 3 specimens of January-February had fully mature testes (14×5, 13×5 and 10×5 mm.) and they were certainly breeding. On 27 January a nest with c/2 was found 6 ft. up in a bamboo clump in secondary jungle (Settihälli). In this locality it was the only dove besides *S. orientalis*.

Streptopelia senegalensis cambayensis (Gmelin). The Little Brown Dove.

Specimens collected: 553 ♀ 7-1-40 Marikānivē (2,500').

Elsewhere noted: Bandipūr, Begūr, Sātnūr, Thōndēbhāvi, Nāmadachilumē, Hiriyūr, Kolār Gold Fields.

[Measurements: 1 ♀ Bill 16.5, Wing 124, Tail 104 mm.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects dry open country less wooded than that favoured by the Spotted Dove, but sometimes the 2 habitats overlap at the seam. These facies preferences are most noticeable in the dry season when their boundaries are better defined than during or just after the rains.

The specimen had a mature ovary with the largest follicle measuring 3 mm.

Streptopelia decaocto decaocto (Frivaldszky). The Indian Ring-Dove.

Specimens collected: 356 ♂ 16-12-39 Sātnūr (2,500'); 425 ♂ 23-12-39 Makli-drūg (2,800'). *Biligirirangan Hills*: M₂₅(G) ♂ 20-9-34 (2,000'—Satyamangala), M₃₇(G) ♂ 15-7-34 (3,000'—Udahatti, Eastern base).

[Measurements: 4 ♂♂ Bill 19.5-21.5, Wing 169-174, Tail 129.5-133.5 mm.—H. W.]

Resident. Common. Confined to deciduous biotope. Prefers drier and less wooded facies than the Spotted Dove, and often met side by side with the Little Brown Dove.

Elsewhere noted: Bandipūr, Begūr, Thōndēbhāvi, Marikānivē.

Both the December specimens were breeding: testes 17×6 and 17×7 mm. Major Phythian-Adams took an egg at Gündlüpet, 28-7-38.

Enopopelia tranquebarica tranquebarica (Hermann). The Red Turtle Dove.

Specimens collected: 366 ♂, 367 ♂ 17-12-39 Sātnūr (2,500'); 554 ♂ 7-1-40 Marikānivē (2,500').

Elsewhere noted: Kolār Gold Fields.

[Measurements: 3 ♂♂ Bill 16.5-18, Wing 136-140, Tail 84-89 mm.—H. W.]

Resident. Confined to deciduous biotope. Affects dry, open, secondary and scrub-and-bush jungle, and the neighbourhood of cultivation. The preferential facies of this dove is nearer that of the Ring Dove than of the Spotted Dove.

All the 3 specimens had testes enlarged to breeding size: 13×6, 16×5 and 17×6 mm. Major Phythian-Adams has taken eggs at Gündlüpet 28-7-38.

(To be continued.)

THE LARGER DEER OF BRITISH INDIA

BY

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Part III—The Sambar (*Rusa*),

(*With 3 text-figures*).

(Continued from Vol. xlvi, No. 4 (1943), p. 572).

Genus **Rusa** H. Smith.

(The Sambar).

Rusa, Hamilton Smith, Griffiths' An. King., 5, p. 309, 1827, and of most recent authors as a genus or as a subgenus of *Cervus*.

Type of the genus:—*Cervus unicolor*.

Distribution from Ceylon and India eastwards to the Philippines and beyond.

British Indian representatives of this genus are the largest of the typically Oriental Deer, approaching the Shou in size, but differing from *Cervus* in external characters similar to those of *Rucervus*, namely the long, bushy tail, absence of rump-patch and more extensive rhinarium, the chief external difference being in the antlers which are much simpler and carry normally only two terminal tines, the anterior or outer of which represents the trez tine of *Cervus* and may be longer or shorter than the other.

In the skull the auditory bullae are smaller than in *Rucervus* and closely resemble those of *Cervus*, (Fig. 1) only very seldom projecting slightly below the level of the basioccipital bone; but the chief cranial characteristic of typical *Rusa* lies in the great depth and size of the gland-pit, which far surpasses that of the other genera, and has a protrusible gland;¹ the vacuity also is relatively longer. A further difference from *Rucervus*, but resemblance to *Cervus*, is the presence of the upper canine tooth in the female.

Although the Sambars (*Rusa unicolor*) of the British Indian Fauna are referred in recent literature to two subspecies, one, *Rusa unicolor unicolor*, from Ceylon and most of India, the other,

¹ In some of the small Sambars from the Far East the gland-pit is relatively smaller and shallower and the gland is not known to be protrusible.

Rusa unicolor equina from Burma and Assam, distinguished from the first by its shorter antlers, I find evidence for the admission of three, the Indian form being separable from the typical Ceylonese form, *R. unicolor*.

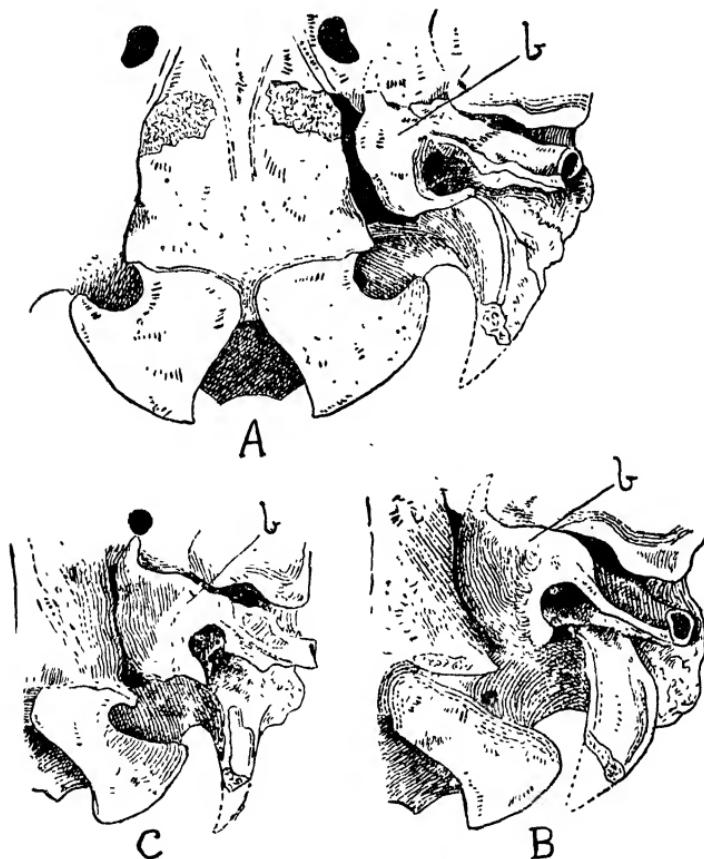


Fig. 1.

A. The small, flat left auditory bulla (b) of young-adult ♂ Sambar (*Rusa unicolor nigra*) from South Coorg (Shortridge).

B. The relatively larger, swollen auditory bulla (b) of adult ♂ Swamp Deer (*Rucervus duvaucelii*) from? Barainga (Earl of Derby).

C. The same of adult ♂ Thamin (*Panolia eldi*) from Burma (Zool. Soc.).

The light, falling from the right, throws the inner half of the swollen bullae of B and C into heavy shadow, whereas in A the flattish bulla casts no shadow.

They may be briefly diagnosed as follows:—

- a. Tips of the antlers variable, the posterior-inner tine usually shorter, sometimes longer than the anterior-outer, sometimes equal to it, the anterior-outer usually but not always definitely continuing the line of the beam.
- b. Antlers and skull on the average smaller. *unicolor*.
- b¹ Antlers and skull on the average larger. *nigra*.

Tips of the antlers less variable, the posterior-inner tine always shorter than the anterior-outer, which always definitely continues the line of the beam. *equina*.

Rusa unicolor unicolor, Kerr.

Cervus axis unicolor, Kerr, Anim. Kingd., p. 306, 1792.

Cervus axis major, Kerr, Anim. Kingd., p. 306, 1792.

Cervus albicornis, Bechstein, Allgemeine Uebersicht vierfuss.

Thiere, 1, 1799.

Rusa unicolor unicolor, Phillips, Man. Mamm. Ceylon, p. 337, 1935. (excluding references to Indian specimens).

Locality of the type:—Ceylon, as restricted by Hamilton Smith.

Distribution:—Ceylon.

Distinguished from the Indian Sambar, with which it has hitherto been united, by its average much shorter antlers which are not known to exceed 34 in. in length, and apparently by its smaller skull, although the evidence on this head is scanty.

This race can be soon dismissed since there are hardly any Ceylonese specimens in the British Museum to describe.

My information about the antlers is derived mainly from Phillips's volume. He states that their general average length is 26 or 27 in., the longest recently procured being $32\frac{1}{2}$ and $33\frac{7}{8}$ in. In Ward's Records, 1935, p. 22, several are entered ranging from $27\frac{1}{2}$ to $32\frac{1}{2}$ in. As regards the terminal tines Phillips states that they are generally approximately equal in length, but, if unequal, either may be the longer. On plate 35 he figures two heads. In the upper figure the antlers are of the primitive 'rusine' type, with the front-outer tine continuing the beam and greatly exceeding in length and thickness the hinder-inner tine. In the lower figure the two are short and subequal in size, resembling apparently rather closely the prongs of a hay-fork. On pl. 34 the two tines appear to be nearly intermediate between the previous two.

No ♂ skulls are available for description. But a ♀ skull from Aldie Patmas, C.P. (Phillips) is that of a youngish adult which had apparently attained its full length dimensions. Its total and condylobasal lengths are respectively 320 mm., about $12\frac{4}{5}$ in., and 315 mm., about $12\frac{3}{5}$ in., nearly 2 in. shorter than the average of five ♀ Indian skulls referred to under *nigra*. But the second Ceylonese skull, collected for the Survey by Mayor at Durgali C.P., would have been a little longer than Phillips's. Its condylobasal length is the same, namely 315 mm., and its total length a little greater; but it is a younger skull with the premolars of the first set still in use and its last molar just appearing in the bone. Since it had not quite reached its full length, it may be assumed that the two Ceylonese skulls would be about 1 in. shorter on the average than the Indian skulls, justifying provisionally the conclusion that the Sambar of Ceylon are smaller on the average than those from the mainland.

The technical name of this race was given by Kerr to a Deer described by Pennant (*Hist. Nat. Quadr.*, 1, p. 106, No. 48, 1781)

as the 'Middle-sized Axis', a species as large as the Red Deer, with the ground-colour like that of the Axis but never spotted, the antlers strong, rough and trifurcated, meaning three-pointed. From hearsay evidence, there being no type, he cited Ceylon, Borneo, Celebes and Java as its localities. The name was restricted to the Ceylonese Sambar by Hamilton Smith in 1827.

I have included the names *major* and *albicornis* in the synonyms for the following reasons. Both were given to the 'Greater Axis' of Pennant (*op. cit.*, No. 48¹); but in Pennant's first description (*Syn. Quadr.* p. 52, No. 41, 1771), the species, based on a pair of antlers in the British Museum without the least trace of locality or history, was described as having the antlers of the same shape as those of the Axis and trifurcated, but large, very thick, strong, rugged and 33 in. long. Since this description fits the antlers of the Ceylonese Sambar as well as any other, the names may be conveniently disposed of as synonyms of *unicolor*. In 1881 Pennant repeated this description, quoted by Kerr, but added the suggestion that the specimens probably came from Borneo or Ceylon. Acting on this Kerr definitely stated Borneo and Ceylon to be the homes of *major*, adding that its colour was 'reddish brown', both statements being unwarranted inventions.

Gray complicated the question by identifying as the antlers Pennant described, a pair in the British Museum (No. 697 U); and this verdict was endorsed in 1915 by Lydekker, who entered them as the type of *major* and *albicornis*. This claim cannot be upheld. The antlers in question are those of a Sambar, without history, but are very aberrant and not the least like those of an Axis in shape. One only is trifurcate and in this the tine near the summit of the beam rises on its outer side and projects outwards and upwards, a most unusual variation. In these respects the antlers entirely disagree with Pennant's description of those of the Greater Axis.

Rusa unicolor nigra, Blainville.

Cervus niger, Blainville, Bull. Soc. Phil. Paris. 1816, p. 76; Blyth, Journ. As. Soc. Beng., 11, p. 449, 1842.

Cervus aristotelis, Cuvier, Oss. Foss., ed. 3, Vol. 4, p. 503, 1825 and of many subsequent authors either as *Cervus* or *Rusa*.

Cervus leschenaultii Cuvier, Oss. Foss., ed. 3, Vol. 4, p. 506, 1825.

Cervus hippelaphus, H. Smith, Griffith's Anim. Kingd., 4, p. 105, 1827 and of several subsequent authors as *Cervus* or *Rusa*; but not *Cervus hippelaphus* Kerr, 1792 which is a European race of *C. elaphus*.

Cervus jarai, Hodgson, Gleanings in Sci., 3, p. 321, 1831.

Locality of the type of *niger*, unstated but probably somewhere in north India; of *aristotelis*, Nepal; of *leschenaultii*, Coromandel; of *jarai*, Nepal.

Distribution:—India apart from the western desert and semi-desert areas, but not perhaps crossing the Brahmaputra in the north-east, the Assamese Sambar belonging apparently to the next race.

Distinguished from the Ceylonese race by its potentially larger antlers and apparently larger skull.

In Rowland Ward's Records, 1935, there is a long list of antler-measurements ranging in length roughly from 37 to 50 in., almost all of the specimens having been procured in parts of Central India.

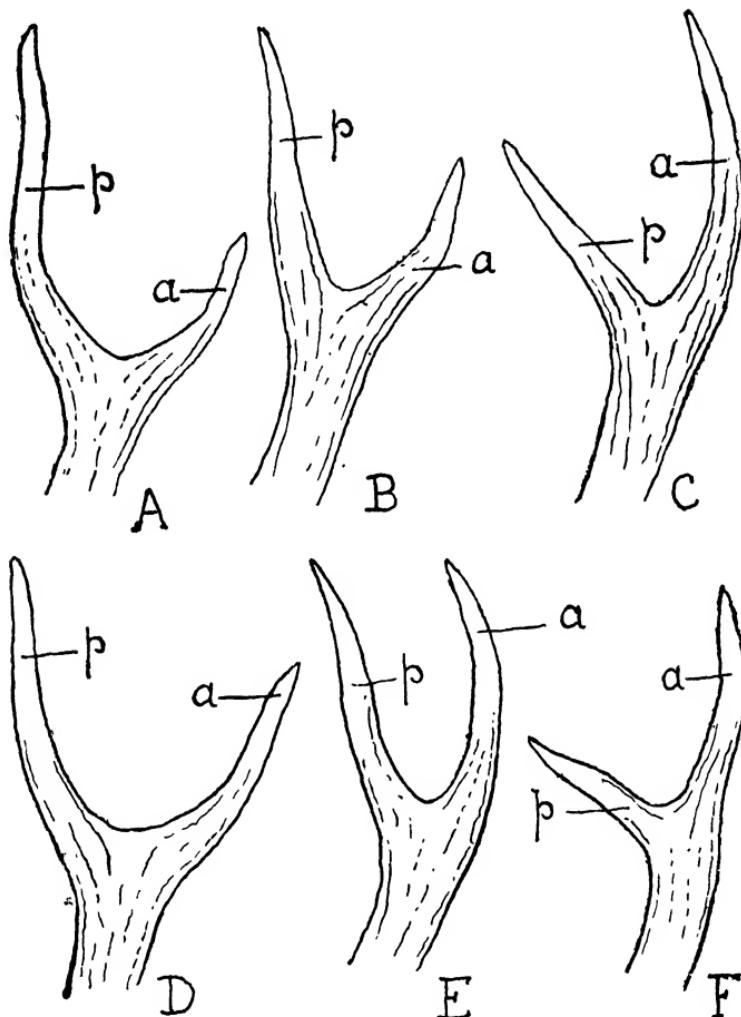


Fig. 2.

Variation in the length and direction of the two terminal tines of the antlers of the left side of the Indian Sambar. *a* the front-outer tine; *p*. the back-inner tine.

- A. Antler, 46½ in., from Chanda, C.P. (Hume).
- B. Antler, 43 in., from Khandwa, C.I. (Sharmon).
- C. Antler, 37 in., from Rohtas, Bihar, (Walker).
- D. Antler 42½ in., from Central India (Anderson).
- E. Antler, 36 in., from Bhopal.
- F. Antler, 27½ in., of the primitive type. Drawn from an example of *equinus* from the Ruby Mines, Upper Burma, (Bruce).

The antlers vary greatly in the comparative lengths and in the direction of the two terminal tines (fig. 2). As a general rule the front-outer tine is erect, definitely continues the line of the beam and is longer and generally stouter than the back-inner tine which inclines backwards, inwards and upwards. Almost equally commonly the two tines are subequal, forming a fork, and sometimes in this case neither can be said definitely to be a continuation of the beam. More rarely the back-inner tine is the longer of the two, sometimes much longer, and in this case also the front-outer tine cannot always be said to continue the line of the beam more than the other. Antlers of this rare type were figured by Blanford in 1891 and by Lydekker in 1915 as if they were characteristic of the Indian Sambar. Three are represented in fig. 2, A, B, D. In C, the much commoner type, the front-outer tine is longer and thicker than the other and manifestly continues the beam. In E, also a common type, the two tines are subequal and the front-outer is in line with the beam. In F, is represented a type quite usual particularly in smaller antlers of the Indian Sambar and characteristic, with minor differences in details, of the races of *Rusa unicolor* found to the east of the Bay of Bengal, in Formosa, the Philippines, Borneo and Sumatra.

Since, as above stated, nearly all the antlers of the Indian Sambar considered on account of their size, worth entering in Ward's Records came from Central India or at all events from districts to the south of the Ganges, a few notes on those from the north of the river, about which little has been recorded, may be of interest. The specimens in the British Museum and the few recorded by Ward give the following length measurements. Eight from Nepal vary from 29 to 35 in., the average being 32 in., two from Oudh are 36½ and 40, with the average about 38; three from Dehra Dun vary from 32 to 40, with an average of 36; three from Garwhal vary from 35 to 46½, the average being about 40; and three from the United Provinces vary from 40 to 46½, with the average about 43. The total average of the series is about 38 in., probably approximately the average of mature antlers of the southern Indian Sambar, if anything a little over it. These northern antlers resemble the southern not only in size but also in the variation of the terminal tines which may be subequal or unequal, quite a large percentage having the back-inner tine the longer. An instance of individual variation is supplied by a pair from Dehra Dun (Hume) in which the right antler is 36 in. long, with the two tines subequal, the left 39½ in., with the back-inner tine much longer than the front-outer approximately as in the head from Chanda, C.P., figured by Lydekker. It is perhaps surprising that none of the north Indian antlers described shows greater proximity to those of the Burmese race than do those from Central India.

The skull of the ♂ Indian Sambar exceeds in length the skulls of the other species of British Indian Cervidae, apart from Wallich's deer (*Cervus wallichii*) and the Shou (*Cervus affinis*). But it is narrower than the skulls of *Cervus*. Although its total length is on the average over 20 mm. longer than in the Hangul (*Cervus hanglu*), the width across the orbit in the latter is on the average about 12 mm. greater, a feature which, combined with the shorter

length, gives the skull a more robust appearance. The skull is very much larger than the skull of the Swamp Deer and Thamin, has relatively considerably smaller auditory bullae and much longer vacuities and bigger gland-pits.

In fourteen skulls the vertical diameter of the orbit varies from 47 mm. in a skull from Palamau to 61 mm., which is exceptional, in one from Nepal (Hodgson), the average being 52 mm. The

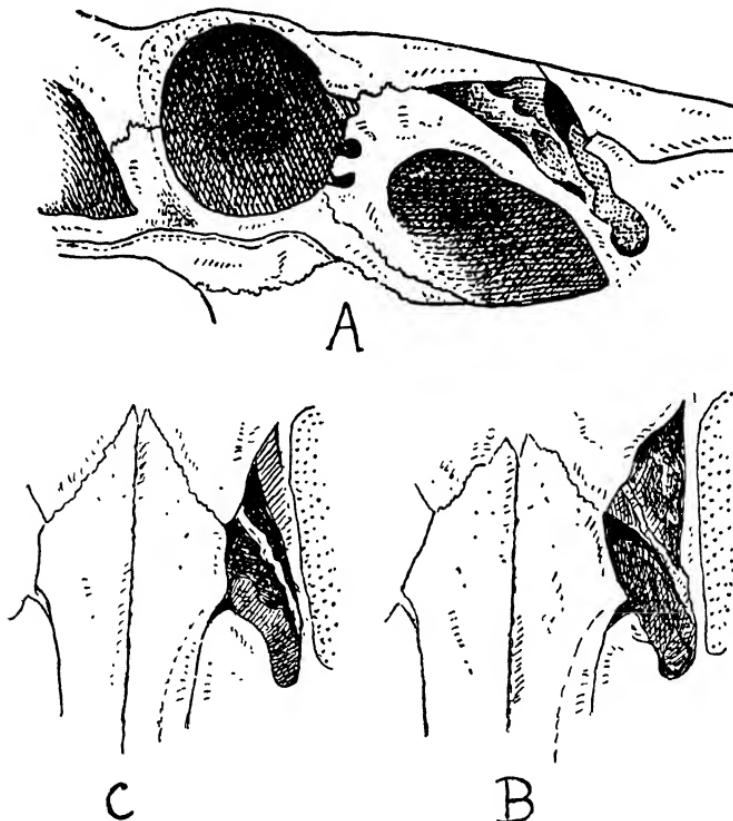


Fig. 5.

A. Orbital area of the skull with the vacuity and gland-pit of a Sambar (*Rusa unicolor nigra*) from Rohtas in Bihar (Walker).

B. Posterior end of the nasal bones, with the vacuity and inner portion of the gland-pit (dotted) of the same specimen.

C. The same of a specimen from Palamau (Walker).

length of the vacuity, which always exceeds the orbit, varies from 60 mm. in the type of *heterocerus* from Nepal to 80 mm., which is exceptionally long, in a skull from Garwhal (Burke), the average being 69 mm. The gland-pit, which is very deep, with well defined edges, usually exceeds in length the diameter of the eye, varies in length from 54 mm. in a skull from Kanara to 64 in one from Khandwa, the average being 58. The free edges of the nasals

where they border the vacuities internally are typically lightly convex but may be almost straight; they vary in length from 12 mm., which is exceptionally short, in the type of *heterocerus* from Nepal to 34 mm. which is exceptionally long, in the skull from Garwhal, which has the unusually long vacuities. On the average the posterior angle of the nasals is about on a level with the posterior ends of the vacuities, sometimes slightly surpassing them, sometimes falling short. But the nasals vary individually in nearby localities. In a skull from Rohtas in Bihar (Captain Walker), with the total and condylobasal lengths 420 and 408 mm., the nasals are much less than three times as long as wide, being 145 mm. long and 60 mm. wide at the widest point, their interfrontal penetration is comparatively short and the angle they form nearly rectangular and not quite reaching the line of the ends of the vacuities. But in a younger, but adult skull from Palamau (Captain Walker) with the total and condylobasal lengths 416 and 397 mm., the nasals are considerably more than three times as long as wide, their length being 150 mm. and their greatest width 45 mm.; they are correspondingly narrower (Fig. 3, B, C) throughout, with a deeper, interfrontal penetration, the angle they form being acute and surpassing by about 6 mm. the ends of the vacuities.

As regards the length of the entire skull, the longest two are those from Rohtas and Palamau above mentioned. Out of thirteen adult skulls nine surpass 400 mm. in total length, the shortest of this category being Hume's skull from Chanda with a total and condylobasal length of 403 and 382 mm. The localities and total length of four, which fall short of 400, are as follows:—Nepal 398, Kanara 395, Garwhal 394, Rajputana 390. In the last three of these the condylobasal length is not available; but another skull from Nepal (Hodgson) has the total and condylobasal lengths 405 and 386 mm. and in one from Kumaun (Vanderbyl) those lengths are 407 and 390 mm. From these data it seems there is no difference in the size of the skulls of the Sambar found to the north and south of the Ganges. The average total length of thirteen skulls ranging from Kanara to the Himalayas is 405 mm.; and the condylobasal length of ten is 392 mm.

The particulars cited above apply only to ♂ skulls collected by sportsmen not interested in hinds. But the collectors for the Mammal Survey of British India secured several adult ♀ skulls in perfect condition. Three were from widely separated districts in India. Their localities and total and condylobasal lengths are as follows:—Sitabani, Kumaun, (Crump) 361 and 350 mm.; Mahableshwar, Satara, (Prater) 363 and 353 mm.; Wottekolle, S. Coorg, (Shortridge) 367 and 350 mm.; Nallamalais, (La Personne) 370 and 358 mm. Their uniformity in length is very close, the total length being about 367 mm. (14 3/5 in.) and the condylobasal length about 353 mm. (14 1/5 in.). A young ♀ skull was also secured by Shortridge at Makut, Coorg. An adult ♀ skull from Coimbatore (R. C. Morris) is a trifle larger than the largest of the preceding, its total and condylobasal lengths being 372 and 362 mm., but these measurements hardly appreciably increase the average length given above, of the skulls of ♀ Indian Sambar.

With regard to the names applied to the Indian Sambar, it is unfortunate that *niger*, based by Blainville on a painting, is several years older than the frequently quoted name *aristotelis* given by Cuvier to a sketch of antlers from Bengal sent to him by Duvauzel who reported that the stag was common in Nepal and towards the Indus. Since Bengal in those days extended considerably to the north of the Ganges and Duvauzel collected to the north of that river, *aristotelis*, like *niger*, belongs to the north Indian Sambar. But Cuvier supplied the Central and South Indian form with the name *leschenaultii*, based on a sketch of antlers from Coromandel. The future may show that the Sambar found north of the Ganges differ from those to the south of it; but since there is insufficient material to decide this point, I provisionally adopt the name *nigra* for all the Indian Sambars apart from those occurring in Assam.

Rusa unicolor equina Cuvier.

Cervus equinus, Cuvier, Oss. Foss., ed. 2, 4, p. 45, 1823, and of subsequent authors including Lydekker, Cat. Ung. Brit. Mus., 4, p. 78 containing bibliography under *Cervus unicolor equinus*.

Cervus malaccensis, F. Cuvier, Hist. Nat. Mamm., 1, pl. 10, 1824.

Cervulus cambojensis, Gray, Proc. Zool. Soc., 1861, p. 138.

Rusa dejani, Pousargues, Bull. Mus. Paris, 1896, 2, No. 1, p. 12, 1896; G. M. Allen, Mamm. China and Mongolia, 2, p. 1169, 1940 as *Rusa unicolor dejani*.

Rusa unicolor equina, Pocock, Ann. Mag. Nat. Hist. (11), IX, p. 518, 1942.

Locality of the type of *equinus*, Sumatra; of *malaccensis* the Malay Peninsula; of *cambojensis* Cambodia; of *dejani* Szechwan.

Distribution :—From Sumatra, through Malaya to Burma and Assam, Siam, Cambodia, Cochin China, Annam, Yunnan, Szechwan, Hainan.

Distinguished from the Ceylonese and Indian races by the terminal tines of the antlers being much less variable in their respective lengths, the front-outer always definitely continuing the line of the beam and being longer and thicker than the back-inner which projects inwards, backwards and upwards from its inner side; the antlers also are much shorter on the average than in the Indian race, with the brow tine longer compared with the beam and there is some evidence that the skulls are a little shorter on the average.

According to Peacock (Game Book for Burma, p. 124, 1933) the average length of the antlers in mature Burmese Stags is about 26 in., 30 in., or a little over, being considered large. This was confirmed by H. C. Smith (Wild Animals of Burma, 1, p. 39, 1935). In Ward's Records for 1935 the picked Burmese heads entered as trustworthily measured range from 29 to 33 in. In a skull from the Ruby Mines (Bruce) in the British Museum, the antlers are 27½ in.; a pair from the Garo Hills, Assam (Hume) are 28 in.; but a pair labelled Assam (Cutler) are only 19½ in. From Malewoon and Victoria Island, Tenasserim Lyon (Proc. U. S. Nat. Mus., 31,

p. 585, 1906) measured four heads with antlers ranging from about 23 to 33½ in., the average being 27 in., thus agreeing with the previous entries; and in Ward's Records 1935 a few no doubt picked heads from various parts of Indo-China ranging from about 28 to 33 in. are entered, showing close agreement with Burmese antlers. There thus appears to be very little difference in the average size of the antlers in the Sambars of continental Asia to the east of the Bay of Bengal. For these the oldest available name is *malaccensis*. There is some evidence, however, that in typical *equina* from Sumatra the antlers may be smaller. For instance a pair in the British Museum (Robinson) from Korinchi is 22 in. and in a series of ten from eastern Sumatra recorded by Lyon (*Proc. U. S. Nat. Mus.* 34, p. 633, 1908) the range is from about 15½ to 20½ in., the average being only 18 in. approximately. But although there is no evidence that all these specimens were fully developed, the data suggest that the typical form of *equina* from Sumatra may have on the average smaller antlers than those from the mainland, justifying the separation of the latter as a distinct local race, *malaccensis*. But since the evidence is unsatisfactory, I leave the accepted nomenclature undisturbed.

There are only two adult ♂ skulls of this race in the British Museum. They differ a good deal in details. One from the Ruby Mines, Upper Burma (Bruce), with a total length of 421 mm. is a few mm. longer than the longest known skull of *mgra* from Rohtas, but its condylobasal length of 400 mm. is 8 mm. less. The vertical diameter of the orbit and the length of the vacuity agree tolerably closely with the average of the Indian race; but the gland-pit is exceptionally long, 74 mm., exceeding by 10 mm. the longest recorded from India i.e. from Khandwa, which is 64 mm. The other skull from Assam with a total and condylobasal length of 380 and 372 mm. is younger and much shorter, but appears to have attained its full length. Its orbit, 57 mm., is large, but the vacuity, 53 mm., is exceptionally short, whereas the gland-pit, 60 mm. long, is approximately equal to the average in the Indian race.

As regards the length of the skull of *equina* Lyon (*Proc. U. S. Nat. Mus.*, 31, p. 585, 1906) recorded the basal length of three adult ♂ skulls from southern Tenasserim. From these I compute their condylobasal lengths to have been approximately 370, 375 and 395 mm. respectively. Of one adult ♂ skull identified as *dejeani* from Yunnan, G. M. Allen recorded the occipito-nasal length, from which its condylobasal length may be estimated to have been 384 mm. The average condylobasal length of these four skulls and of the two in the British Museum works out at 383 mm., about 10 mm. less than the average of nine ♂ skulls of *R. unicolor nigra*.

Three adult ♀ skulls were collected by Shortridge for the Mammal Survey at Banlaw in Mergui, Thagat in Tenasserim and probably at Tenasserim Town, although labelled merely Tenasserim. They vary individually in details. The Mergui skull has the vertical diameter of the orbit 46 mm., the vacuity 70 mm. long and the gland-pit 48. In the Thagat skull the same areas are 44, 46 and 57 mm. and in the Tenasserim Town skull 49, 61 and 48 mm. The vacuity is exceptionally long in the Mergui skull and the gland-pit

in the Thagat skull. The averages of these areas in the three is 46, 59, and 51 mm. respectively, both the gland-pit and the vacuity exceeding in length the vertical diameter of the orbit. Both the orbit and the vacuity are smaller than the average of the five ♀ skulls of the Indian race; but the gland-pit is a little longer. The three skulls similarly vary in length, the condylobasal being 353 mm. in the skull from Thagat, 345 in the one from Mergui and 332 in the one from Tenasserim Town. But Lyon recorded from the Malay Peninsula a much bigger ♀ skull, which had a condylobasal length, I estimate, of about 373 mm. The average in the four skulls works out at about 351 mm., only 4 mm. less than in the five ♀ skulls of the Indian race.

(To be continued)

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. ST. J. MACDONALD,

(With 1 plate, a map and 3 text-figures).

(Continued from Vol. xliii, No. 4 (1943), p. 620).

PART IV.

FISHING FOR MAHSEER.

*'Wild and wide are my borders, stern as death is my sway,
'And I wait for the men who will win me—and I will not be won in
a day;
'And I will not be won by weaklings, subtle, suave and mild,
'But by men with the hearts of Vikings, and the simple faith of a
child;
'Desperate, strong and resistless, unthrottled by fear or defeat,
'Them will I gild with my treasure, them will I glut with my meat'.*

R. S.

The attributes of the good angler (1), The Mahseer's idiosyncrasies (2), Size no indication of age (3), Diet of Mahseer (4), Power of jaw (5), Spawning (6), Method of taking bait (7), Spoon versus other lures (8), Capt. F. Stonham's Note on Plug bait (9), Spoon bait and scale effect (10), How fish attains greater size (11), Spinning for Mahseer (12), Where to look for Mahseer (rapids) (13), Sketch of good water lettered (14), Pools (15), How to work water and the cast (16), Known water (17), How Mahseer rise (18), Monotony of one bait (19), Point of rod (20), Selection of water (21), Lacy's log of good and bad days with my summary (22), Wade cautiously (23), The element of luck (24), Water and temperature (25), Following in a boat (26).

OTHER METHODS OF FISHING FOR MAHSEER (27), The fly and fishing with fly (28), Gram fishing for Mahseer (29), Method of Fishing (30), Gram for bait (31), Hooks (32), Cast lines (33), Tackle (34), Other tips (35), Paste fishing for Mahseer (36), Baiting with paste (37), Points relating to heavy fishing (38).

THE ATTRIBUTES OF THE GOOD ANGLER.

1. The patience of Job; the eye and observance of the eagle; the perseverance of the termite; the hands of an artificer; the touch of a musician; the temper of a saint; and, above all, an unsatiable ambition to learn.

2. *The Mahseer's idiosyncrasies.* Before dealing with the actual fishing, it will be as well to consider a few important points about the mahseer which either directly or indirectly influence the methods to be adopted. The mahseer has certain idiosyncrasies, which are not in conformity with the salmon or trout. He likes clear water, in fact the clearer the better; the rougher and whiter the more does he love it; thunder and rain may or may not subdue his capricious appetite. They are taken in the winter, summer, spring and autumn. His size is no indication of his wants, the little chap of 1 pound or

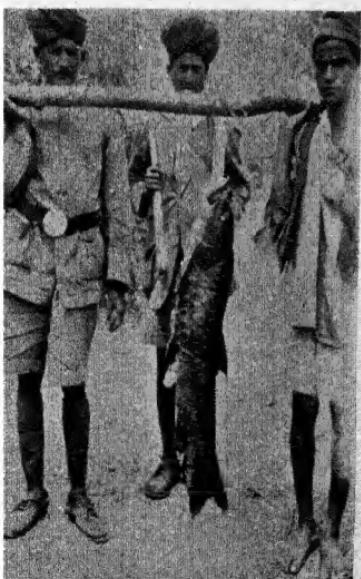
4. COMMON TYPES OF MAHSEER TAKEN IN MOST NORTH INDIAN RIVERS.



(1) A typical 'Golden Mahseer', 50 lbs.
Barbus (Tor) putitora (Hamilton).



(2) Thick-lipped 'Mahseer', 52 lbs.
Barbus (Tor) putitora (Hamilton)
With hypertrophied lips.



(3) The 'Black Mahseer', 26 lbs.
Barbus (Tor) putitora (Hamilton)
Melanic Form.



(4) Short gilled, deep-bodied type, 25 lbs.
Barbus (Tor) tor (Hamilton).

Note.—Dr. Hora's work on the Game Fishes of India has revealed that there is no reason to believe that 1, 2 and 3 are separated forms.

less will ambitiously take a 4-inch spoon, with the same readiness as the monster of 30 or 40 pounds takes a half-inch fly spoon; and most important of all when considering mahseer fishing, we have to bear in mind a fish ranging from a few ounces to one of 5 score pounds or more.

True, that in most rivers his size can be ascertained fairly accurately, but this is by no means the case with most of the larger rivers, which have the monsters mingled with the game little fellows of a few pounds. Few anglers who have fished the larger rivers have not experienced getting into one of these iron-clads while indulging in the gentle art with 9 ft. fly rod and fine gut casts, and many must be the recollections and regrets of good fish lost.

3. *Size no indication of age.* Fishing for large and small mahseer are things apart, and call for methods as widely separated as those used for the monsters of the sea of 100 pounds or more, with those employed for the game little trout of a pound or more, in a stream barely 3 feet across. The size of a mahseer is not necessarily any indication of age. A ten-year old fish in a small stream may only be 5 pounds, whereas a ten-year old fish in a big river may grow to 20 pounds or more. Like the salmon in Britain, the mahseer is the aristocrat of the Indian waters. His chief characteristic is the first rush. As soon as he is hooked he may go 50 or 200 yards without stopping, depending on his size and the strength of the water. His choice for rapids and broken water makes him a strong fish, this is further illustrated by his area of fin. The mahseer, like most of the Indian fish, is not very tasty, and is inferior to the Butchwa and Murrail; some people, however, prefer his flesh to any other.

4. *Diet of Mahseer.* He is a fish with a variety of tastes. He will take small fish with the same readiness as he will worm and paste; a fig or berry on the surface; or a frog on the bottom; leaves and scum in a still backwater; small birds or birds' eggs; lizards, locusts, flying ants, weeds and small fish. He will even de-tick an animal lying in water. The best and most convenient bait is the artificial spoon, which should always be the first course on the menu when fishing for him, unless, of course, it is known that he will not touch spinning bait, as is the case in some rivers. Persevere with dead or live bait and if these two produce no luck, then try baiting a rapid with paste balls and fish with a similarly baited hook, the same applies to gram or fig berries. I have known of mahseer waiting under bridges over the Ganges canal near Hardwar, for young martins to fall out of their nests. A 40-pound fish was caught in this way. Eggs we will leave aside, because of the difficulty in mounting; flies, locusts, green caterpillars, etc., are easily fished with, and well known.

5. *Power of Jaw.* It is difficult to realise the crushing power of a mahseer. I have had a 3-inch copper spoon (one-eighth of an inch thick), and the treble crushed in a more convincing manner than if it were done in a vice. His teeth are located in the throat well back, and inlaid in rolls of muscle. Cutting out the teeth, convinces one of where the strength lies.

I am inclined to believe that the damage is done by the teeth

and not in the mouth chamber, as is commonly supposed. I am opposed to Thomas in this, but in defence can only quote two instances. In the first, I found the tail treble crushed, while the fish was hooked by the top treble of my mount inside the mouth. The throat was cut and bleeding, and the crushed treble had on it the white leathery lining of the throat. This was an 11-pound fish.

The second instance was when I found the tail treble broken off and in the throat, the fish being hooked by the top treble. This was a 21-pound mahseer, the treble was one of Hardy's improved types, and was bent out of shape. If the damage was done by the lips or in the mouth chamber, as stated by Thomas, and generally believed, broken and bruised fingers would be common among fishermen and anglers: whereas the professional fisherman will readily put his hand down into the mouth of a fish (mahseer) to extricate a hook, which he would hardly do if these powers were in the mouth. I have never myself experienced a bite or met anyone who had. A horny pad on the roof or floor of the mouth would surely be provided by nature, were these phenomenal powers in the mouth. Dr. S. L. Hora writes to me on the subject as follows:—

'In the case of Cyprinoid fishes, the pharyngeal teeth are developed as a compensation for the loss of the teeth in jaws, and for this reason they perform all the functions of the ordinary teeth of fishes.' (See *B. N. H. Journal* xli, pp. 790-94).

6. *Spawning.* Spawning is done two or three times in the year, chiefly during the monsoon, and just before, when the snow water comes down.

In April 1928 at the confluence of the Mali and N'Mai river in Burma, I took, with a friend, nearly 1,200 pounds of fish, and the majority were full of spawn.

Different rivers though have different periods. Spring-fed rivers are probably later and not until the monsoon sets in properly. Fish then work up the smaller streams, and deposit their eggs. Mahseer are not always edible during this period, and cases of poisoning or colic have been recorded.

Dr. Hamid Khan, Ph.D. (Cantab), writing in the *B.N.H.S. Journal*, Vol. xli, No. 1 dated August 1939, under the heading 'Study of the sex organs of Mahseer', deals fully with his collection and study over most of the Punjab rivers of mahseer throughout the year, and his conclusions, based on careful observation, would certainly indicate that in the Punjab anyway, mahseer have been found gravid three times in the year. His own words sum up the position fairly conclusively:—

'There is thus strong evidence to show that the *manseer* spawns more than once during the year. Most of the Indian Carps, such as *Labeo rohita*, *Labeo calbasu*, *Cirrhina mrigala*, *Catla catla* and others spawn in June and July when the rivers are flooded with the monsoon rains and lay their eggs in one batch once in the year (Hamid Khan, 1924). The Mahseer, however, as a study of its sex organs reveals, seems to spawn *firstly*, in winter, in January and February, *secondly*, in May and June, when the snow melts and the rivers are swollen and *thirdly*, from July to September, when the rivers are flooded with the monsoon rains. It is for this very reason that fry of the Mahseer of all ages is seen during the whole of the year in the hill streams of Kangra, Hoshiarpur, Jhelum and Rawalpindi Districts.

'There is, however, hardly any evidence to corroborate the views of Thomas (1897) that the Mahseer lays its eggs in batches, "just as a fowl lays an egg a day for many days." The simile does not appear to be appropriate, as in the case of the Mahseer all the eggs contained in the ovaries seem to be laid at the spawning time and the ovaries become empty. At the approach of the next spawning season the ova reappear, increase in size, swell the ovaries and are laid again. It may, therefore, be said that the Mahseer does not lay its eggs in three batches, but that it spawns three times in the year, and that all the eggs in the ovaries are laid in each spawning season.'

This might well be taken to represent the conditions of the other river systems in India, which are snow fed, or such spring-fed rivers that join these larger rivers in the hills. The conditions in the case of the smaller rivers that are not influenced by snow water, and have to flow long distances over the plains before joining these rivers, will need further elucidation, and I think some variation may be found to exist.

Though the mahseer is essentially a bottom feeder, his special choice being among rocks for stone loach, and shell fish, he will take below and on the surface, whatever dainty morsel is in season. I have seen them under a fig tree, almost jump out of the water to take a fig as it touched the surface; so when fishing for him, exploit all means and depths before abandoning your efforts with the poor assurance that fish are not on the feed.

7. *Method of taking bait.* From what I have been able to study of the Mahseer taking a spoon or small fish, they will either surprise it from below, or follow from underneath turning over the bait as they take it.

That small fish come to the surface, as soon as a big fellow is signalled, partly substantiates this. I have also seen a fish take up a position in a small cove and dash out at passing fish with the same up and round movement; this also partly accounts for fish getting foul-hooked so often in the face, the hook catching them as they pass over the spinning bait.

Whether I am right or wrong, it was my belief in this that caused me to devise a special form of mount,—a small treble on top and a larger tail treble. The head treble I find, invariably hooks the fish, if it is hooked outside the mouth. I think also, that a mahseer takes or tries to take a bait head first, as a snake takes a frog or rat. This would also account for the smaller hook fouling the fish outside the mouth, the trace obstructs the fish taking the bait from the front end, and in failing as he turns over it, he is hooked in the cheek. I have often experienced fouling a fish with the hook shaft running away from the mouth, and the tail hook wrapped under and fast under the jaw.

8. *Spoon versus other lures.* Before we consider bait, let us first of all be agreed on the object of the bait. It is to attract and deceive. I have dealt in a previous chapter on the fish's senses, as I understand them, that is that he is attracted to the lure by the vibrations set up, that he has detective rather than sharp vision, as a secondary organ to his feeling, and to these two senses we may add taste or smell, as he is well equipped with barbels.

How does the spoon fit these two points of attracting and deceiving, as compared to dead bait, plug, spinners, etc.?

The spoon of the Myitkyina type, certainly sets up more pressure waves than a dead bait, as it spins faster, and is not as well adapted in shape to the water as the dead bait (Fish), so setting up greater pressure waves of a kind, the roughly hewn scale effect, on the convex side, must give additional aid in the water much as the teeth of a saw, in wood. The plug has a greater displacement than the large spoon, but has not the action or disturbing factor, in the water. The plug's superficial area, though slightly larger than that of the spoon, has considerably less bearing surface, so that the action in the water is reduced. The whole surface area of the spoon grips the water and revolves, whereas the diving shield on a plug is only half an inch square approximately, and in the jointed types the rear section has about as much again. Spinners have even less than the plug. So that in 'Attracting', I am inclined to the belief that the spoon covers a greater range, and would register to a fish at greater distances than the other bait under consideration.

We now come to the second point, 'Deceiving'. Here the other two senses of the fish come into play to a greater extent. In a close-up vision of a spoon revolving, a fish is able to see no more than we can, probably less, as the sharpest perspective the eye can take in is, I believe, at one-fifth of a second. So that a spoon revolving fast, retains its deceptiveness to the eye of a fish, though the chemical senses of taste or smell would be to the fish's advantage and consequently against the spoon; but in the case of the plug the main portion is stationary in the sense that the body maintains the upright position with the hooks below, and consequently does not deceive the eye to the same extent that a fast revolving spoon would, the detection of the chemical senses is the same in both cases, but the hooks on a plug are not revolving but dangling from the body of the plug, and would show up if carefully scrutinised, and then as we must suppose a mahseer cannot recognise a treble hook as such, he may reasonably be expected to take it to be a pectoral fin—if he is as inquisitive as all that!

The hooks on a spoon revolve with it. The spinner shares the advantage of the spoon in moving around its own axis, though not as fast. So that on the points considered so far, the spoon would seem to have an advantage over the plug and spinner, and the spinner a slight advantage over the plug, but the important point of how the action of each, in water, is conveyed to a fish, remains unsolved, and it is probably that in this the plug has its main advantage, though this is only surmise on my part.

As has been pointed out previously fish are near sighted, so in fast water a mahseer has not much time to examine the bait, therefore each of these would give results; but in the slower water of pools and runs a fish is able to be more fastidious, and this is why dead bait is so much more killing than the other baits, as the chemical senses must be the fish's convincing factor, unless of course there is competition in a shoal, when the boldest fish takes first. So that considering the spinning baits on these lines, I am left convinced that the spoon is the best lure, unless of course we know the fish of a particular river will not take it. But for the supporter

of the Plug Bait, I reproduce a note by Capt. Franklyn Stonham, I.M.S., who has very definite views on the merits of this lure, based on the excellent results he has had in the Donn and other rivers.

Plug baits for Mahseer by Captain Franklyn Stonham, I.M.S.

9. 'There is now little doubt that the plug has come to stay as a favourite bait for mahseer and other Indian fish. Not only has it "caught on" in the river round the Dehra Dun district but I have had reports of its success in Ceylon, and in other parts of India. Its advantages should be at once obvious. Its action in the water is the closest imitation of a genuine fish that has as yet been devised, and as the majority of plugs are lighter than water and only dive when pulled, they are seldom lost. The wriggling action in the water effectively disguises the hooks which are sent into vibrations, and the fact that they do not "spin" or rotate renders anti-kinking devices superfluous and besides there is very much less wear on the lines.

'There are many makes of plug to be had, many types, and many finishes. For mahseer I find the finish is of minor importance provided that it is a natural scale finish. Those painted in more freakish manner such as white body and red head do not appear so attractive and to be a little dogmatic I may state that what I have found the best colours are Natural Perch, Natural Pike, Golden Shiner, Red side Scale, and Green mullet, the latter two being my favourites. I have tried almost every conceivable type of plug and both from my own experience and that of my angling colleagues I consider that the "Pfluger" Pal-o-mine stands supreme. It is beautifully finished, the hooks can be easily changed or renewed, a very important point, and it darts through the water with a most convincing slight wriggle, close to the surface, and exactly mimics a *chilwa*. Remember that when mahseer are "taking" they are feeding at or just below the surface, and the old motto slow and deep for big ones in no way is generally applicable to mahseer fishing.¹ Next to the excellent products of Pfluger I would place the Heddon Company's "River Runt". This has the same advantages of Pfluger's Pal-o-mine, and is even more beautifully finished and can be had of translucent material. However, the diving plane is difficult and they have some tendency occasionally to come out of the water. I do not think that the jointed plugs have much advantage over the straight ones except in quieter water and if they are not kept dry after use there is a slight though definite tendency for the wood from which they are made to crack. I almost invariably use the largest size, i.e. the 4½ inch Pal-o-mine as small fish are not averse to taking so large a bait, and I have taken mahseer as small as one pound on them, and besides they are easier to cast being heavier. The sinking type of plug such as the "Live Wire", "Neverfail" and "T. N. T." minnows are good for occasional use in

¹ I am afraid I cannot hold with this view, and unless he fishes deep in some of the great rivers and pools of Burma and Assam, the angler would be destined to failure.

deep still water, when the fish are not rising. They have all occasionally brought me success.

A most important feature about plugs is the hooks. Those fitted to most American plugs are not quite strong enough to be relied upon for heavy mahseer, and after trying many varieties I find the best type to be those put up by Pflugers as "Extra strength" size 10 tinned trebles. The conventional mahseer treble is not such a good shape and unnecessarily heavy. They upset the balance and movement of the plug and besides their absolute rigidity results in a greater tendency for the plug to lever them out of the mahseer's fleshy mouth. The hooks fitted to some plugs of English manufacturers are far too small and besides the British firms so far do not seem to get the hang of plugs at all.

Plugs can be fished on any kind of spinning tackle, but their main problem is their extreme lightness, as the largest size only weighs $5/8$ — $3/4$ oz. according to the type used. If the conventional type of heavy spinning tackle is employed a weight may have to be added to the trace which is not desirable as it has a tendency to make the bait go too deep and it interferes with its action, besides the risk of fouling the plug on the bottom, especially if one has an overrun and losing it. This practically never occurs if no lead is used. Overruns are fairly frequent if one attempts to cast light baits with heavy tackle. I have now completely abandoned the two handed rod in favour of what is known as the American bait Casting rod. These rods are conventionally about $5\frac{1}{2}$ feet long and a standard 5 ft. rod weighs only about 5 ozs. For all ordinary mahseer fishing such a rod is quite heavy enough and I have landed mahseer up to 45 lbs. quite easily on a 5 oz. rod. I prefer however to use one a little more powerful when I expect heavy fish so that I can play them hard as I usually like to play the fish against the maximum amount of drag I think the tackle will stand. For that reason I use a rod of $6\frac{1}{2}$ ozs. to 7 ozs. $5\frac{1}{2}$ ft. long which is, I think, perfectly adequate to land any mahseer. Using a rod weighing 6 ozs. 1 dram I once landed a 50-lb. fish in less than twenty minutes in heavy water.¹ For heavy mahseer I advocate the use of a "Norka" reel carrying 200 yards of 24 lb. test braided silk line such as "Lignum Vitae" or a "Nonpareil", and for lighter fishing I recommend the "Supreme" reel with 200 yards of 12 lb. test line.² The trace should be one ft. of fine cabled steel or phosphor bronze wire with a "Cooper" or "Stronghold" snap, which works like a safety pin, to attach the bait, and a "Lyons" ball bearing swivel to attach the line to. The ball bearing swivel will always revolve no matter how hard it is pulled on, and though not essential for plugs it allows spoons or spinning baits to be employed as well if one wishes, and only one such swivel is required. Solid wires are not to be recommended for traces as they may very easily break

¹ I think an average on fish over 20 lbs. would break this theory, and toy tackle would be next to useless for negotiating the really heavy water in most of the larger rivers in India and Burma.

² I have quoted instances in this book, where 200 yds. of line has proved insufficient for the large fish, and 150 for light and medium fishing.

if kinked, though fine stainless piano wire exhibits this tendency to only a minor degree, if one wishes to make up one's own traces. Solid wire can be twisted to attach it to swivels, but cable wire must be soldered, taking precautions not to let the wire become overheated by too hot a soldering iron.

The advantages of one-handed casting are numerous. The tackle being very light in proportion to its strength, may be used all day without the slightest fatigue, which is a very decided advantage in hot weather. If one becomes proficient in over-head casting it is extraordinarily accurate, and using the reels mentioned above casts of thirty to sixty yards can be made with a little practice. The reels are multiplying and the plugs can be moved at any speed, and can be even cast upstream and worked down with a strong current. The multiplying action saves much of one's energy and is of the utmost advantage in playing a fish as slack line can be recovered almost immediately. Braking is done by thumbing the spool and is semi-automatic as a sudden rush on the part of the fish pulls the rod down and moves the reel away from the thumb, and besides this thumb pressure can be finely graded. Another very great advantage is that the rod can be held and the fish can be played *entirely with one hand*, leaving the other hand free to assist oneself climbing rough banks, or wading strong water without the aid of a cooly, and this feature is also an advantage if one wishes to gaff the fish oneself.

This type of tackle has been frequently criticised because it limits the length of the trace. My experience leads me to the conclusion that there is not the slightest disadvantage in a one-foot trace.¹ One only needs the trace in the event of a fish with teeth, such as a goonch, being hooked, and to obviate the risk of the hook points accidentally fraying the line. Otherwise it is open to question if a trace is necessary at all, as the dull black colour of the two lines mentioned above makes them no less invisible than any ordinary wire trace. Another criticism is that these short rods do not allow the line to be lifted over bushes. This argument does not bear closer examination as the rod can be held high above the head and the fish played, and besides this, there seldom are any bushes close to a mahseer stream.² In fact, there is often no vegetation within several hundred yards of the water except when it rises during the monsoon. One disadvantage is that weights of over 1 oz. such as a chilwa on a spinning mount are not easily cast with one hand as neither the rod nor one's muscles will stand up to the strain, and for such heavy baits a two-handed rod is better. Still when one is accustomed to plugs one seldom wants to use chilwa.

Lastly, let us consider the reel. For this style of fishing the level wind anti-backlash multiplying reel is to be preferred. They are all American and many makes and types may be obtained. The only British example I know of, though an excellent reel, has too

¹ In this connection I have expressed my views freely elsewhere.

² I think this view is also a questionable one; in some rivers certainly.

small a line capacity to commend its use for anything but light mahseer fishing. These reels are entirely automatic and do not overrun but they are complicated and are easily put out of gear by careless use. They require constant attention to give good service. The level wind mechanism is the most vulnerable part in dusty India and must be frequently oiled and cleaned. Still if one is careful with one's tackle they give long hard service. On all the better ones the bearings etc. are adjustable for wear and the level wind pawl is supplied in duplicate and this spare is built into the reel, other spare parts are standardised and can be obtained from the makers if ever required. If one buys one of the better types and looks after it, will give almost unlimited trouble-free service. I have used a Norka solidly for four seasons and it is still as good as new. It casts baits from $\frac{1}{2}$ -1 oz. admirably, but the smaller reels work well and give satisfactory length casting even less than $\frac{1}{2}$ oz. provided not too heavy line is used.

'In conclusion I may state that in my opinion the heavy two-handed rod and many of the methods now employed in mahseer angling are doomed to early obsolescence, and the short light rod and light tackle will appeal more strongly to anglers if only from their sporting features. These rods can be obtained made entirely of steel, and the superior grades of these are delightful to use and besides they are quite unaffected by climate.'

10. *Spoon bait and scale effect on spoons.* It is difficult to explain what a fish imagines a spoon to be. I am reluctant to say he thinks it a fish; and it is a perfectly logical assumption to think that he, like most creatures, has a certain curiosity for new things, catches it with his mouth, as we would with our hands, and so comes to be hooked.

Mahseer prey more on sick and damaged fish, or small fish at a disadvantage. A spoon may present a likeness to a wounded or sick fish, but I am afraid I can see no resemblance to a healthy fish more especially in still or slow running water.

In a rapid it is quite another matter, for a feeding fish is an opportunist, and has no time to inspect a spoon dancing about in broken water. He darts out and takes it. This is substantiated by watching a fish in a pool while trolling. He will come up and even follow a spoon; change over to a dead bait and he takes it, which might be the work of the barbels on the mouth, referred to by fishermen as 'coming short'.

In the case of scale-marked spoons, I found I never had a blank day, when every other kind failed; and with them I was, in 23 days, able to catch 800 pounds of fish, the best being 75 pounds and then after having worked through many kinds and varieties. Try a spoon similar to the Myitkyina type as shown in the chapter on 'Tackle', get it to spin any speed in water below you, and see for yourself whether or not the scale effect shows up.

11. *Hen fish attain greater size.* Fish, like falcons and eagles, appear to reverse the general laws of nature, in that the hen fish (spawner) attains a greater size than the cock fish (milter). It may be a provision of nature, to assure that the spawn of a hen fish can always be reached by the cock fish when she migrates up into small

streams. If the tables were reversed it might be possible that the cock fish through his size, could not always get where the hen fish selected to deposit her eggs. Only a surmise on my part, and an assurance to my own curiosity!

12. *Fishing for mahseer: Spinning.* I will start by assuming that the angler has now learnt the use of the tackle, can cast a bait, has seen to all the important factors of the reel working well, the joints of the rod firm, the trace correctly attached, the spoon bait and lead mounted, and the end of his line tested.

13. *Where to look for mahseer: Rapids.* The rapid will provide the best sport for spinning, as feeding fish invariably collect in the 'bottle necks' where small fish are to be had at some disadvantage. Small fish will collect in the quieter water of rapids, that is in

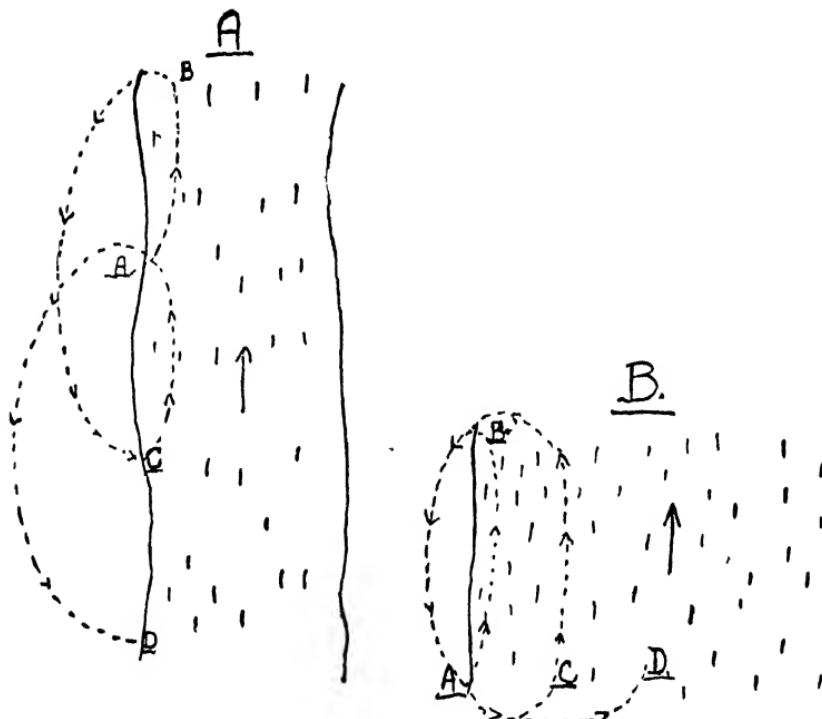


Fig. 1.—Start at 'A' and work down to 'B'; then come around to 'C' and work down to 'A' and up to 'D', and so on in each case.

'feathers' behind rocks; in the eddies and swirls by the edge of the fast water; or below falls where the force of the water is broken, affording them temporary rest from the fast rushing water of the main current. So that generally speaking this is the water we should consider and work thoroughly.

Just above runs are spots where the water flows deep and strong, and where it gathers itself for the final plunge down the rapid. This is smooth and oily looking and should always be tried.

Before starting to fish take stock of the water, and look for movements of fish, gulls, kingfishers, etc. Make a mental note of the likely places and number them off in your mind. Tackle each in turn. If the rapid is long and narrow quarter it off in your mind and fish each section thoroughly, starting from the top of the section each time. See diagram (A) overleaf.

If on the other hand it is a wide and shallow rapid, and allows wading, quarter it off and wade in so many yards at a time, and work each section thoroughly. See diagram (B) overleaf.

It is a sweat sometimes, but I assure you it pays. Work the edges first, then move in at suitable distances, and work down as far as you can. When you are taken or you move a fish fix the point in your mind at once by setting two points on the bank, a tree, boulder or brush wood, for future use and reference.

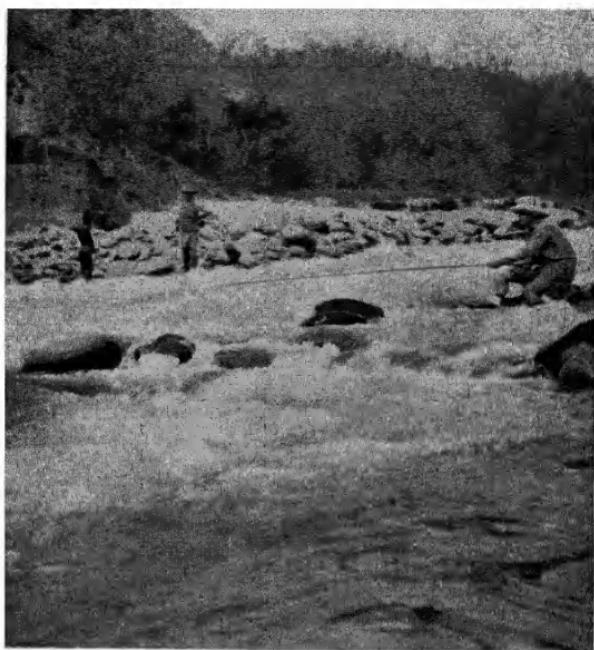
Work all the water in a rapid from the head, where it breaks over stones and is shallow, to the point where it 'fans' out in the pool. Fish will take anywhere in such water, give the 'white feather' behind rocks and boulders special attention, and the 'V' formed by the fast and reverse water; work these as quietly and with as little disturbance as possible. If the rapid is large, and a boat is necessary, follow the same procedure. Have the boat held at intervals to allow you to fish all the likely water, then move up or down ten yards or so and repeat the operation.

A very good tip and one that frequently pays with dead bait, is to allow your bait down the rapid by degrees, past boulders, swirls and eddies, very often this attracts fish lying at the side or behind a submerged boulder. In fact, wherever the water is fast and narrow, flowing over large boulders, it is a good plan to fish it in this way first, or wherever the water does not allow of casting and spinning, owing to the narrowness of the run, or the 'boil' being under a large overhanging rock, or the many other similar conditions met with. Allow the bait to play about in such water for a minute or two, then move it down to the next place and so on. Very often it also pays to pause awhile after wading out into a rapid as, however careful, one is sure to disturb the water and be detected by fish. Allow the water to settle down and get used to you, so to speak, so that the fish too will be assured that you are just part of the rapid. It is most extraordinary how this pays, and how fish will almost bump up against you, if you keep perfectly still.

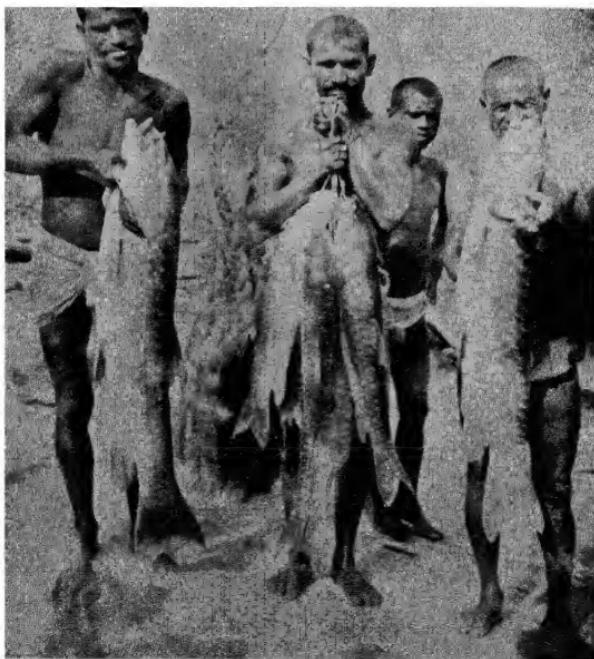
14. In order to simplify these notes, I have included a sketch of a mile of ideal water and lettered the best places, to look for fish.

The map is taken from my log book, and illustrates water likely to be met with in most hill rivers (*vide* reverse of adjoining plate).

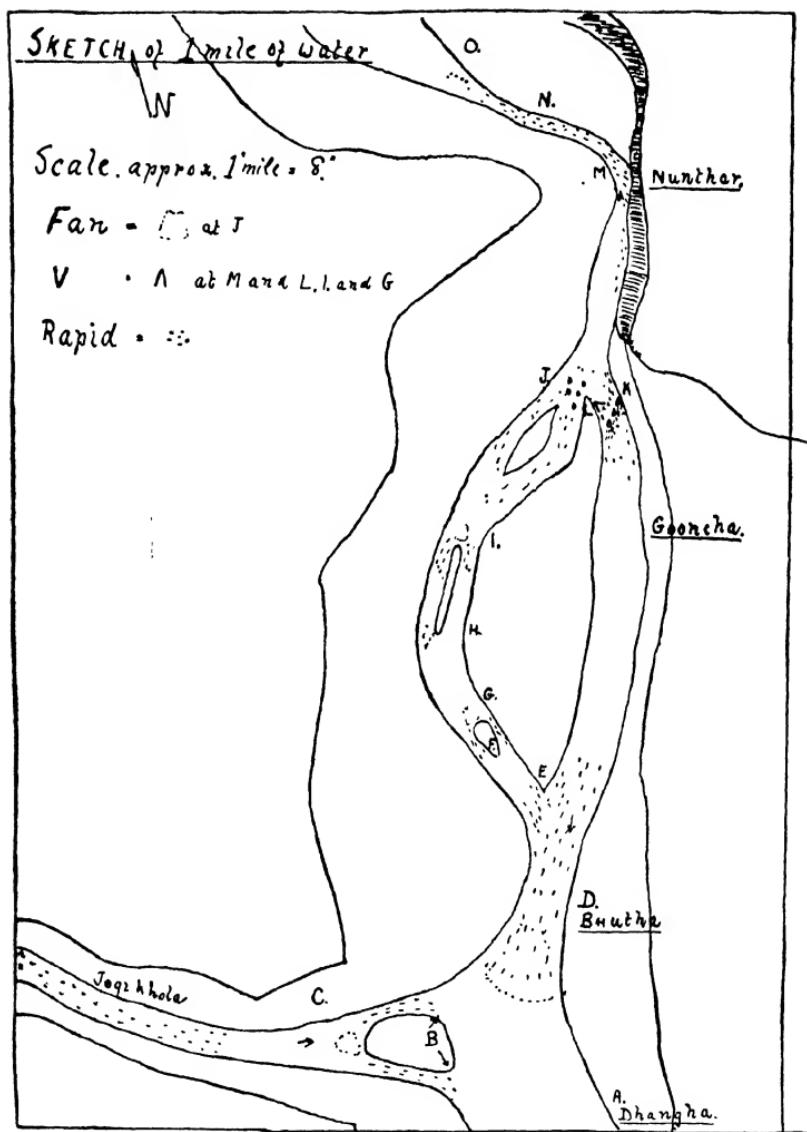
(A) Is a large pool, 600 yards long, by 600 yards across with 30 ft. of water in the deepest parts. It is the first pool below where the river leaves the hills, always a good place if sufficient protection is afforded by boulders. Trolling across from where the Jogi Khola joins (below and above would be likely water), also up the right bank, where the still water has banked up below the junction at (B).



'White water' where large fish are usually taken.



Part of a bag taken in the rapid shown above. Two best 30 and 25 lbs.



Sketch map of water likely to be met with in most hill rivers.

(B) The junction is not very imposing, the Jogi Khola has about $2\frac{1}{2}$ ft. of water, where it runs over shingle into the main river, and falls over a steep bank abruptly into deep water. Below such banks, and in the quiet water between the two channels, usually holds fish, but it must be approached very carefully, and is best fished from the island.

(C) Is the 'fan' which is almost without exception good if boulders are present, as in (J). This is water *B. bola* (Indian trout) love, and I never failed to take two or three each time I fished it.

(D) Is the best rapid in this stretch of water, from the junction of the two channels to the 'fan' into the pool, about 40 yards short of the junction (B). It is fast water over large boulders 5 ft. in diameter, with the main current about 40 yds. across and 10 ft. deep, shelving to the sides for about 20 yards where the water is 3 to 5 ft. deep, permitting wading. This is excellent water for big fish.

(E) The point at the junctions of two streams, generally has a 'ridge of boiling water running out for some distance, caused by the banking up of the lesser streams by the stronger. This is generally a certain find for feeding fish. If the water is deep at the point, it should be fished from above, and the spoon or bait allowed to work down. Work all the water from the actual point to where this boil disappears. Fish will take anywhere in such places.

(F. H.) Are modifications of (E), and should be fished in the same way. It is light water 4 or 5 ft. deep with boulders dotted about, and about 25 yds. wide. Best worked from (I) through (I), (H), (G) and (F), first from one bank then, after a rest, from the other, keeping the sun in front of you and wading in where necessary. It is ideal fly spoon water. The 'fans' at (G) and (I) should be approached from above in each case.

(G. I.) Are 'fans' falling away into small rapids on either side of the island, and are best worked from the banks and above.

(J) Is an ideal 'fan', defined by dotted line, and a certain find for fish, having plenty of 'feathers' behind large boulders. It is 50 yds. across, 3 to 5 ft. deep, and connects the two large pools Gooncha and Nunthar.

(K) Is 'white water', broken up by three huge boulders, forming 'feathers', and falling 5 ft. in as many yards. This is big water.

(L) This is a 'V' formed by the reverse water and rapid, (marked in with a 'V').

(M) Tail of rapid starting at (O), into deep pool below cliff. This is also a 'V', with slow water tailing into the pool.

(N) Deep very fast water, narrow and deep over large rocks or slabs of sand stone.

(O) Similar to (J), but without 'feathers' or boulders, running in a deep narrow channel over shingle.

Gooncha and Nunthar are both huge deep pools, ideal for fish. The former is rocky at the head and sandy at the tail, the latter runs along a cliff, very deep with huge slabs of sand stone dotted about at intervals.

15. *Pools.* The water in a pool may be still and glass like, or slow moving with odd swirls caused by out crops of rocks, shallow banks, bays, etc., so that I can only refer my remarks in a general way to the most suitable water.

The really big fellows will usually be taken in the pools by fishing deep and slow, with a dead bait or spoon. I myself like to work a trolling bait diagonally across a pool, so that the bait is carried well below the boat, and at least 20 yards or so away. Work all likely water near rocks, swirls, over boulders, and along the edges of the flowing water formed with the still back-water where you will generally find froth and foam collected. Best of all is the tail of the pool where it shallows down, and just before it starts to flow down the next rapid.

16. *How to work water.* The following diagram shows how to work a promising bit of water. Vary the length of cast each time, if possible, then move up or down stream, and repeat the same system of casts.



Fig. 2.—

rocks, is where big fish mostly lie when feeding.

17. *Known water.* If you are fishing water that is protected by a club, and a log book is kept, the first thing to do and before you assemble your rod, is to study the notes and any sketches there may be of the water you are going to fish. Jot down as many of these as necessary in your pocket book, locate the spots and always tackle the best water first. If it is a rapid, you should start at the bottom, if you want the big ones.

The larger the fish the lower down he lies in the rapid, or he may be at the head of the pool, usually where the rapid tails into it. If you are on a new piece of water, of which you have no previous information, try to get out the evening before to see where fish rise.

Fish lie with their heads up stream, and bait-spoon or natural, cast up stream, is often more successful than casts made across or down. Method has to be suited to water conditions, and for these directly up-stream casts, reeling in has, to be more rapid, and a multiplying reel is an advantage, almost a necessity.

There are always back-waters on the edge of rapids, and the water works round in a circular movement, in the opposite way to the current. Sit and watch from some convenient spot or spots, with the assistance of an attendant if necessary, each taking a

section of water, to observe which looks the most promising. As the sun is beginning to set, you will usually see mahseer rising over the best places.

18. *How Mahseer rise.* They rise much the same as the dolphins and porpoises in the sea or large rivers, and are easily distinguishable. Their hog backs come right out of the water; but it is not always that you will enjoy such delectable sights. In many fine rivers the fish are not seen, or their presence known, until the reel screams out its music.

Try all the good looking water on one side, before attempting to fish the other. It is always owing to that spirit of adventure which is in us, that the further bank is the better one. The rapids, if shallow, are best in the morning and evening, and the deeper quieter water during the day.

Fish deep and as near the bottom as you dare, and don't be satisfied until you have felt it once or twice. If however, you are losing your tackle each time, take off the hook mount, and survey the bottom with only the lead and spoon. Get the hang of your water in this way and then fish deep where you dare, and shallow only where you must.

Some of the water is so deep in Burma rivers, that I know of a most experienced angler, who has caught some large mahseer of 70 and 80 pounds, who used to count ten after a cast with a 4-oz. lead on, paying out line the whole time before he started to wind in his bait.

I am convinced that this is the secret of catching the really big fellows. Let us consider our grandparents and their lack-a-daisical mood. They are not moved by the latest hit in the town, to which the young 'bloods' flock. They are quite satisfied to sit in an easy chair and take the news and diet that is served on them, with as little trouble as possible to themselves. This is how I reason also for the grandmother mahseer. If you put your spoon near her into the depths, she will take it, otherwise she will let it go to the younger and more active fish.

19. *Monotony of one bait.* Here again if you strike or lose a fish at one spot, do not go on hurling your spoon at him the whole day. You know what poached eggs daily for chota hazri taste like? You are not altogether kindly disposed to the servant! A fish with a torn or hurt jaw is going through much the same feelings, if you continue to serve up the spoon from which he has just escaped! Rest the water and come back to it in a couple of hours. Remember your fish—the real big one—is generally a hen, and extend the psychological factor to our own kind. Women are ever inquisitive and easily caught, change the fashion in spoons, and hope the fish, like women, will bite!!!

It has been my experience when fishing, that as long as one lands the fish one strikes one can keep on fishing the same spot with success, but as soon as you run and lose a fish, they seem to go off the feed. Whether they have a means of communicating danger to each other or not, it is difficult to say.

Let me here draw an analogy of the human ear and the lateral line of a fish. It is possible, that as certain sounds have adverse

effects, such as the soothing sound of music or the irritating yap-ping of a dog, or child crying; so, vibrations set up by the different lures, may have similar reactions on a fish. Which are soothing, and which are annoying or alarming, is what the angler must find out for himself.

Remember these three big points when playing a fish.

1. Point of rod up.
2. Line always taut, and
3. Play a fish off the reel and through the rod.

20. *Point of rod.* The moment you are taken, and your reel screams, the first action should be to raise the point of your rod, as high as you can, or give him 'butt' as it is called. This puts both pressure on your fish as well as saves your line slackening, for even that fatal second. It also serves as an indication of when to reel in, for you will soon learn how the rod is forced down, and your arms pulled almost straight, by the first mad rush of a big mahseer. It is at the end of the rush that the critical time comes; for if the line is the least bit slack when the fish turns, the chances are that you lose him. This is the commonest and easiest fault while playing a fish.

By playing the fish off the reel and through the rod, I mean to imply that you should not use only the one or the other. If you overbrake your reel, you are putting all the strain on the rod, and likewise, if you point the tip of the rod in the direction of the fish, you are direct on the reel, and you lose the whole advantage of the rod; compromise between the two and you get the correct pressure; if your reel is large enough, and takes 300 yards of line, you can rest assured that you have enough line for the largest mahseer. Don't brake a reel or foul the handle of the drum while it is revolving. You will come to grief if you do; just study what you are doing. With a brake on you are unable to gauge what pressure you are applying, however expert you may be, and by putting your hand in the way of the handles, you are sending out a succession of jerks which go down the line to your hook-hold, and furnishing the best way of releasing your fish. We all know what it is like to pull a firm peg from the ground by gentle pressure, but a few taps and it comes away. Exactly the same applies to the hook hold, and what your hand is causing to the fish's mouth by fouling the handles.

21. *Selection of water.* I am a firm believer, when on a short holiday, in sticking to a piece of water you know is good, rather than spending a week of leave by exploring new places; but if one has plenty of time on hand look for new water every time.

22. Lacey's *Angler's Hand Book*, gives the figures of his luck, through a career of fishing for mahseer, and these are interesting, as he must have kept careful notes. He works it out over 10 days, in the following way (Inserted from Lacey's *Angler's Hand Book*).

'I do not wish to discourage the beginner, but to take an average all round, say that out of ten days steady fishing, taking rivers and seasons about, the angler will, as a rule, have 5 days blank, 4 days on which he will have perhaps, moderately good sport, but the tenth will be the really good day, which should make up for all the rest.'

The above is an average, and such has been my own experience while fishing exclusively for heavy fish. I think that 7 days out of ten, good fishing can be had with fly spoon, and something on the other three.

I like to reason this subject in the same way as heavy mahseer fishing compares with big game shooting, and light fishing with the 'scatter gun'. In the first place blank days are to be expected; we do not get every tiger that kills, or every bison or tsine we track, but seldom do we go out with 'scatter gun' or fly rod and not get something.

I give as a matter of interest, the log for my last seven trips which are representative of the average river. (See p. 54).

As will be seen no exceptional days were experienced, as is sometimes the case when the small fish are running or the large fish are collecting. My companions on these trips were, with the exception of two, all new to the sport, so that we may justly conclude either that sport is better than it was when Lacey wrote his book *The Angler's Hand Book* or modern methods are proving more successful.

23. *Wade cautiously.* Movement above where fish are feeding, causes some disturbance and displacement both of water and gravel while wading. This is connected with some unusual occurrence to fish, and they become alert. The hungry fish will look for food, the shy fish for danger. Adapt your methods to meet both cases.

24. *The element of luck.* It remains a mystery why on one day fish will feed ravenously, and the next day, (though even to the keenest observer both days appear identical) not a fish will move. Time in trying to study the causes is never wasted, and notes made, such as temperature of water and other cognate matters, always assist one. I have had equally good luck on cloudy and sunny days, windy or still days, and even thunderstorms have not disturbed the fish. They have their feast and fast days, as we have ours, but the reasons for this are what every angler should try to elucidate.

25. *Water and temperature.* Unlike the English fish, the mahseer will take in gin clear water, in fact the clearer the better. Do not despair if water is running dirty; quite often fish will take a spoon in water so discoloured that you cannot see the bottom in a depth of 12 inches. If you know the water it helps, as fish will generally be found in the same places as when the river was clear. I have taken fish with spoon in water a companion of mine refused to fish in. After all, if the lateral line has the function we attribute to it, why should a spoon spinning in a good spot, not attract a fish? Dead bait used the same way is also effective, and here suit your methods to the chemical senses. The functions of the eye in clear water, are replaced by those of smell and taste in discoloured water.

The temperature of water has its effect on fish. When the water is cold the river will seem quite lifeless. Falling water has its supporters, but I think we are, comparatively ignorant of the 'whys and wherefores' of our scaly friend's capricious appetites. Study good days as well as bad, both are equally important. Do not fall into a groove of supposition that it is useless to fish at any time,

SUMMARY

Date	Locality	Fish	Weight	Average	Rods	The Day's Best	Fisher's Best	Best Bag in Pounds	No. of Fishing Days	Blank Days	Percentage of Successful Days.	Remarks
						The Day's Best		Fisher's Best		Best Bag in Pounds		No. of Fishing Days
11th April to 8th May 1928	Mali H'Kas Burma Sari and East Ranganga Kumaon U.P.	53	861½ lbs.	16·25 lbs.	1	50, 42, 1	75 lbs.	145½ lbs.	28	12	57 %	Practically all the time was devoted to heavy fishing. Fly spoon and heavy rod used equally.
4th April to 8th June 1935	207	870½ lbs.	4·3 lbs.	1	34, 18½ 36, 30 7 lbs.	40 lbs. 96 lbs. Goonch	73	50	16	68 %		
10th to 27th October 1937	Nepal	28	274½ lbs.	9·8 lbs.	1	21, 18, 16½ 10, 5, 6, 4½, 2½	29½ lbs.	92½ lbs.	18	3	83 %	
11th to 26th April 1938	Do.	102	558½ lbs.	5·4 lbs.	2	29, 23, 16, 9 and ten others 13, 5½, 4½	123½ lbs.	16	Nil	100 %		
12th to 31st March 1939	Do.	46	207½ lbs.	4·5 lbs.	1	1½ 27½ lbs.	27½ lbs.	20	2	90 %		
21st to 31st October 1940	Lashya Kumaon	155	142 lbs.	·9 lb.	3	21 fish	9½ lbs.	34	10	Nil	100 %	All light work with fly spoon.
23rd March to 6th April 1941	Nepal	161	605½ lbs.	3·7 lbs.	4	12 fish	37½ lbs.	90½ lbs.	15	Nil	100 %	Mixed work. Fly spoon and spinning.

except the mornings and evenings. More especially where streams meet, or when a river has been discoloured by rain water, the fish start to feed irrespective of the time of day, and the moment it starts to clear. They may be hungry from not having fed for three or four days, and are on the look out for food as soon as the water is clear enough to allow of it.

There is no better way of meeting the local people than to talk to them in their own homes about sport and their crops. Play the gramophone to them, dress their sores, give the children a few sweets and keep both ears open for local ideas. The primitive people, such as one usually meets on a fishing trip, are largely dependent on their wits for fish and flesh, and have experience handed down to them for generations. Exploit and adapt their suggestions and ideas, and with your own knowledge you can very soon arrive at a killing method. This recalls to me an incident at Namti in Upper Burma, where I tried to catch some mahseer in a pool just below a village by spinning; the fish would not look at my bait. An old Burman saw my failure, and as I had been there before asked me if he should collect the fish, to which I gladly assented. He then started breaking up pumpkin leaves and throwing them into the slow water, which in a short time was alive with mahseer. I attached a hook and light gut cast, and with this leaf caught seven nice fish. The village feasted in my honour and we became very good friends for ever after.

26. *Following in a boat.* Boats, if available, are the best things in which to follow fish. One can concentrate on the fish the whole time, and not have to worry about where to put one's feet, or how to climb over rocks while following down a bank. The Burmans, or better still the H'Kamti Shans, in fact all the fisherman tribes in India, are wonderful at manipulating a boat through the most treacherous water. They seldom if ever lose their heads, and have a wonderful sense of correction while the boat goes hurling down a rapid.

If, as usually happens some time or other while on a fishing trip, the water is discoloured, baiting can be done quite successfully by getting rice or flour mixed with earth or any other ingredients, such as bran, oilcake, and the more foul tasting things, bad meat etc. and fixing it into two wicker baskets, tied over one another. This is placed in a run, where the water churns up and washes it out through the sides of the basket by degrees, when it works down stream and fish move up towards it. A live or dead bait should be anchored just below the basket. This gives very good sport, if one is driven to it with no other alternative.

Dead bait fishing is done in the same manner as spinning, and does not call for any special explanation.

OTHER METHODS OF FISHING FOR MAHSEER.

27. I have dealt chiefly with spinning for mahseer, which is quite the most pleasant of all, and the way most of the large fish are taken. I have also dealt with trolling, and dead and live bait fishing.

It will suffice to say a few words on how to fish with fly, gram, and paste, which cover all the ways we know of circumventing this fish. All these methods, with the exception of paste, might be considered under light fishing.

28. *The fly and fishing with fly.* A number and variety of flies are listed in the tackle books, and one must suit ones fancy to the local conditions and tastes of the fish prevailing, which is only picked up locally from experience. Manton's list 12 of the best known, and be it a 'Jock Scott', 'Blackamore', or 'Black Ranger', must be your individual choice.

Sea-trout flies, dressed with sufficiency of tinsel, the two hooks of stouter wire than the flies made for home use, are said to be effective lures for mahseer, Indian trout, Butchwa and other fly takers. They should be dressed to imitate the smaller minnows prevalent in the water being fished.

It sometimes happens that flying white ants flutter in myriads over the water affording a great feast for fish. At such a time they will look at nothing else. The fly known as 'Gibby's Ant' (A & N Stores Bombay) will then prove successful.

In rivers the fly should be used in the same way as for salmon, pulling the fly with uneven speed and occasionally pausing, giving it a chance to spread and assume a life-like movement of opening and closing. Allow the water to play it about keeping the line taut enough to enable you to strike instantly. It is also a good dodge to drop your fly in fast water passing over a steep step, and where it suddenly falls away deep, pay out line by raising the top of your rod, and then lowering it, you must always feel the line or you will miss a rise. Such places usually hold feeding fish. Striking is the same for all fish, and is made by sharply lifting the point of your rod, with the line free. A strike off the reel is good enough for the leathery mouth of the mahseer. In comparison, I think the artificial fly is an inferior bait to fly spoon; and fewer fish, both in size and numbers are taken than with a very light spoon which is made from tin foil or aluminium. It starts spinning the moment it touches the water. Fly has a traditional love attached to it, and keeps your hand in for the home fish when the spot of leave comes along. So, brother angler, weigh its merits for yourself.

29. *Gram fishing for mahseer.* This form of fishing is almost exclusively practised in most of the C. P. rivers, where the mahseer prefers it to any other form of bait.

Fish of ten pounds and under are taken in this way on light tackle, and afford excellent sport on a fine cast, and a small hook with a 9 or 10 ft. trout rod. The tackle for small mahseer is suitable.

30. *Method of fishing.* First select your water. The best places are runs into pools, waterfalls, and bathing ghats, or rocky gorges. This done the selected spot must be baited morning and evening with parched or roasted gram, and when it is thrown in to the water, especially in the case of slow or still water that is very clear, the man who is doing this for you, should be instructed to keep out of view (in the case of runs and waterfalls it is not so

important). If a suitable rock or bush be near-by, all the better, the arm too should not be flourished about in the air when fishing, but the gram flicked from the hip, with as little movement as possible. This is the most important thing about this form of fishing. If you are resident in a place and baiting can be done daily, the fish are in time educated and get accustomed to the sight of man, and will associate him with food, and little precaution will be necessary. I refer more to the visitor to the wild parts of rivers where he may happen to be shooting, and is intending to have an occasional afternoon's fishing under these conditions. Fish may collect in one, two, or four days, depending on the size of the river. When they have collected in sufficient numbers, fishing should commence. The mornings and evenings are the best, the earlier and later the better.

31. *Gram for bait.* Selected grains should be drilled with a piece of wire beaten into a spear point, and large enough to take the eye of your hook. (Special gram hooks are sold by Messrs Verona and Mantons of Calcutta). An orderly or *chaprassi* can be put on to this job the day before; carry a small tin of drilled gram in your pocket for bait.

32. *Hooks.* As already mentioned special gram hooks are offered by tackle dealers. I like Hardy's sharp loop-eyed hooks the best. They are very light and sharp and can be attached or removed from the cast in a moment, and the spring extension keeps the gram in position. Size 11 for one grain, or size 9 for two grains; the eye can be passed through the drilled gram quite easily, and the cast attached by the loop. I am against any form of metal, other than the hook, on the cast or at the joining of the cast to line. This makes Fig. 3.—your line and cast sink faster than your bait, and scares the fish.

33. *Cast lines.* Do not spare gut, and use a six foot cast of 2x. gut.

34. *Tackle.* A small Silex $3\frac{1}{2}$ inch or any other suitable reel serves the purpose. A 9-ft. or 10-ft. fly rod that will throw a small spoon makes the ideal rod for this form of sport. (Hardy's 'Perfection' or 'Gold Medal').

35. *Other tips.* When your fish is hooked, if he makes either up or down stream, follow and shelve him, as far away from your baiting place as possible, so as not to disturb the water; for if you do not move away, he will surely return to the other hungry fish, and splashing and turning, as a hooked fish does, will spoil your sport for a time.

Before leaving the place throw in more gram, so that the fish can again feed after the scare has worked off, and the bolder fish will attract the shy ones.

Lightness of tackle and limited movements, with as little disturbance as possible to the natural elements of the water, are the three things to sum up the precautions to be taken in this form of fishing.

36. *Paste fishing for mahseer.* This covers a much wider range than the two preceding methods, and may be productive anywhere from north India to the south of Burma. It is a bait all varieties



and sizes of fish will accept. Conditions must therefore be adapted to the rivers in which one is fishing.

In coloured water, in the largest rivers, or in the C.P. rivers in the same place as gram fishing is practised, and under similar circumstances, paste will bring the mahseer and other sporting fishes of India to bag, provided the local conditions are taken into account. It is however a dull form of sport compared to the foregoing methods. I have mentioned paste in Chapter X.

37. *Baiting with paste.* This can be done along with gram, in the same places, so that when fish have stopped feeding on the surface, one may try the paste balls on the bottom, a method which generally produces carp, mahseer, or, as I have said before, perhaps any other fish or even a turtle !!

The method of baiting with *Atta* is to make small paste balls the size of Dove's eggs, and throw them in, in much the same way as gram. When you are going to fish with *atta*, the usual few pellets should be thrown in, to collect the fish. When you send down the baited hook amongst them, be it rapids or slow water, keep out of sight as far as possible, or if this is not possible, than as still as possible. As with all wild life it is movement, not form, that alarms.

Baiting a hook for this fishing, can be done in no better way than with paste dealt within the manner I have mentioned in the Chapter 'Scraps from my Note Book'. By boiling it it holds on to the hook, and is not washed off by the rapid water, or the small fish nibbling. I prefer a single hook to a treble, though the treble holds the paste far better. A fair-sized hook, to take a lump of *atta* the size of a dove's egg. Any shape of hook does, and is a matter of choice or fancy. 'Killen wire' for the heavy fish and gut for the medium-sized ones, meets the purpose. The awful snags that these C.P. rivers have, with the knife edge trap rock bottom or sides, gives a fish a distinct advantage over the angler for freedom. For attaching hooks and tying casts, see Chapter V.

For paste fishing for the very large mahseer taken in the rivers of Mysore the bait is made from 'ragi', a staple grain of Mysore and other parts of South India. This paste is strongly adhesive to the hook, and both the balls thrown in as ground bait, and those used on the hook, are the size of large hens' eggs. December-January and September-October are the best months. Single hooks, size 4/0 are used, and the turned-down eye is best. Gut or wire trace is not advisable: line should be of dark colour. No float is used: strike should be hard, to drive in the hook, as soon as the fish begins to move.

38. *Heavy Mahseer fishing.* I will conclude this chapter with a few points which require mention, and which are more especially concerned with heavy mahseer fishing.

1. This is hard work and it is only perseverance that brings reward.

2. If you want to catch the monsters you must know where to look for them, and above all, you must get your bait down to the fish.

Get into your mind the ideal water for fly spoon work, then

try to find these conditions in a big way, that is, instead of the rapid being 4 feet deep and 40 yards across, find one 20 feet deep and 150 to 200 yards across. Here, or in deep pools, with slow runs into them, or in bays by the side of rapids.

4. Big water wants a great deal more fishing than does the ordinary rapid. The first cast may only tickle the fish, the second draw or attract him, the third or fourth will bring him to the bait.

If your boatmen can ferry you across the smooth water above one of these rapids, and your nerves will stand it, your reward awaits you. I was taken above the 'Rocks' rapid in the Myitkyina District of Burma, three times in three tries, by monsters. I saw them in the clear shallow water (8 ft. deep), but what with having to make the bank 100 yards away, and the roaring torrent below, either my nerves gave and deprived me of concentration on the fish, or the 300 yards of line proved inadequate.

I gave these monsters best here, and never tried again as it was only asking for trouble. What tempted me to try at all was the monsters I saw rising the evening before. I camped on the bank opposite, and after showing the boatmen fins and tails, the like of which they had never seen, persuaded them against their wishes to try it. (An angler's nightmare).

In conclusion I would refer anglers to Col. R. W. Burton's article in Vol. 41 No. 4 of the *Bombay Natural History Society's Journal*. 'A Mahsir River in Southern India'. It is a complete guide to the Bhavani river, by an able and experienced angler. Also two articles by Major W. B. Trevenen 'Mahseer fishing in the Deccan Lakes' and 'Fishing in the rivers of the C.P.' (Vol. 31, No. 1, p. 120 and Vol. 34, No. 3, p. 700). A well illustrated article by Sir Reginald Spence and Mr. S. H. Prater entitled 'Game Fishes of Bombay, the Deccan and the neighbouring districts of the Bombay Presidency' appeared in Vol. 36. No. 1. of the *Journal* (pp. 29 to 66). It was written as a help to anglers in the Bombay Presidency, but contains information of interest to anglers in most parts of India. It is obtainable in pamphlet form on application to the Society.

ON THE BIRDS OF THE KAREN HILLS AND KARENNAI
FOUND OVER 3,000 FEET.

BY

H. C. SMITH, M.B.O.U., P. F. GARTHWAITE, AND
B. E. SMYTHIES,

Burma Forest Service,

assisted by

The late DR. C. B. TICEHURST, M.A., M.R.C.S., M.B.O.U. etc.

(Continued from Vol. xliii, No. 3 (1942), p. 474).

PART II.

711. *Lanius c. collaroides*. Burmese Shrike.

Previous records.—Karen Hills; Karen (Wardlaw Ramsay).

Specimens.—Nattaung 1♀.

Noted.—Probably breeds in these hills. Not seen at Thandaung.

712a. *Lanius nasutus tricolor*. Burmese Black-headed Shrike.

Previous records.—Karen Hills.

Specimens.—None this year.

Noted.—We did not meet with this species again.

716a. *Lanius schach nipalensis*. Grey-backed Shrike.

Previous records.—Karen Hills 4,000 feet (Wardlaw Ramsay); Taho (Salvadori).

Specimens.—None.

Noted.—One bird was seen in the tea estate at Thandaung on 11 October 1941.

719. *Lanius c. cristatus*. Brown Shrike.

Previous records.—Karen Hills (Salvadori); Karen (Wardlaw Ramsay).

Specimens.—Thandaung 1♀.

Noted.—This bird appeared in the tea estate in Thandaung on 7 May as a passage migrant; others were seen on 9 and 10 October 1941.

724. *Hemipus p. picatus*. Black-backed Pied Shrike.

Previous records.—Karen (Wardlaw Ramsay).

Specimens.—Nattaung 1♀.

Noted.—Several parties were noted in Thandaung in September and October, but it is chiefly a bird of the foothills.

727. *Tephrodornis gularis pelvica*. Nepal Wood Shrike.

Previous records.—Thandaung (Cook).

Specimens.—None this year.

Noted.—Occasionally seen both on Nattaung (where a pair was observed feeding young) and at Thandaung.

729. *Tephrodornis p. pondiceriana*. Indian Common Wood Shrike.

Previous records.—Karen (Wardlaw Ramsay).

Specimens.—None.

Noted.—Not seen, except for one party on Nattaung not identified for certain.

734. *Pericrocotus speciosus elegans*. Burmese Scarlet Minivet.

Previous records.—Karen Hills; Karen (Wardlaw Ramsay).

Specimens.—Nattaung 1♂; Thandaung 1♂.

Noted.—Common.

739. *Pericrocotus brevirostris* subsp. Short-billed Minivet.

Previous records.—Karen 3,000 feet (Wardlaw Ramsay), pine forests of the Salween (Davison).

Specimens.—Nattaung 2♂.

Noted.—Not collected at Thandaung, but probably occurs.

742. *Pericrocotus s. solaris*. Yellow-throated Minivet.

Previous records.—None before 1939.

Specimens.—Nattaung 1♂.

Noted.—Not collected at Thandaung, but may occur.

[744. *Pericrocotus r. roseus*. Rosy Minivet.

According to the F.B.I. it has been recorded from the Shan States and Tenasserim and is therefore likely to occur in our area, but so far there are no records or specimens.]

[746. *Pericrocotus cinnamomeus vividus*. Burmese Small Minivet.

Wardlaw Ramsay obtained it in Karen (elevation not stated). We have not seen it and doubt whether it occurs over 3,000 feet.]

754. *Lalage melaschistos melanoptera*. Pale Grey Cuckoo-Shrike.

Previous records.—Karen Hills; Karen (Wardlaw Ramsay).

Specimens.—Nattaung 1♀ juv.; Thandaung 1♀.

Noted.—Common on Nattaung but at Thandaung noted only at the end of the rains. It is curious that the call-note: 4 notes with the last two dropping in pitch, *wee-wee-weyou-weyou*: should differ from this bird's call in Maymyo

761. *Grauculus macei siamensis*. Siamese Large Cuckoo-Shrike.

Previous records.—Karen Hills and Karen (Wardlaw Ramsay).

Specimens.—None.

Noted.—Not uncommon on Nattaung and also noted at Thandaung.

763. *Artamus fuscus*. Ashy Swallow-Shrike.

Previous records.—None before 1939.

Specimens.—None this year.

Noted.—Not seen at Thandaung but may occur.

769. *Dicrurus macrocercus cathoecus*. Chinese Black Drongo.

Previous records.—Karen (Wardlaw Ramsay).

Specimens.—None.

Noted.—Once only, at Thandaung on 22 October when it was probably on passage.

772. *Dicrurus leucophaeus mohouti*. Burmese Grey Drongo.

Previous records.—Karen (Wardlaw Ramsay).

Specimens.—Nattaung 2♀.

Noted.—Status uncertain. It seemed to be absent from Thandaung in September but was much in evidence in October; after 1 May it again disappeared, so that it may only winter in the hills.

780. *Chaptria aenea aenea*. Northern Bronzed Drongo.

Previous records.—Karen Hills and Karen (Wardlaw Ramsay).

Specimens.—Nattaung 1♀.

Noted.—Occasionally seen both on Nattaung and at Thandaung.

782. *Chibia h. hottentotta*. Indian Hair-crested Drongo.*Previous records*.—Karen Hills (Wardlaw Ramsay).*Specimens*.—None.*Noted*.—Seen at Thandaung in October and March (when it was common), and on Nattaung in evergreen and pine forest up to 5,000 feet.786. *Bhringa remifer tectirostris*. Indian Lesser Racket-tailed Drongo.*Previous records*.—Karen Hills (Wardlaw Ramsay).*Specimens*.—None.*Noted*.—Common both on Nattaung and at Thandaung.[788. *Dissemurus paradiseus rangoonensis*. Burmese Large Racket-tailed Drongo.]

Recorded by Salvadori from the Karen Hills (elevation?); we have not seen it and doubt whether it occurs over 3,000 feet. Cook, who recorded it as common and breeding at Thandaung, must have confused it with the preceding species.]

803. *Acrocephalus agricola stevensi*. Plains Paddy-field Warbler.*Previous records*.—Karenni (Wardlaw Ramsay).*Specimens*.—Nattaung 1♀, 1♂; Thandaung 2♂.*Noted*.—Not uncommon on Nattaung and noted up to 23 April; several birds were observed in the tea estate at Thandaung in March, but they had all left by 24 April. We saw no signs of breeding, and the bird appears to be either a winter visitor or a passage migrant. In the field it resembles *Phylloscopus fuscatus*, and has a similar call-note, but can be distinguished by the fact that it is much less active and more of a skulker; it is also lighter in colour and has a noticeably longer and more ragged tail. It frequents thick undergrowth where there is little or no overhead cover, and though sometimes seen near the bank of a stream it was more often, and more surprisingly, observed on the driest of dry ridges, where it was wont to lie dormant most of the day and come to life only in the early mornings or evenings. It is most difficult to observe, and on one occasion it took a full hour of watching and waiting to get a glimpse of a bird calling in thick undergrowth. The fact that the first specimens were identified by us (incorrectly) as *Tribura* sp. indicates the difficulty of naming these skulking Warblers, even with the bird in the hand.814. *Orthotomus sutorius patia*. Burmese Tailorbird.*Previous records*.—Karen Hills and Karenni (Wardlaw Ramsay).*Specimens*.—None.*Noted*.—Not seen by us.818. *Orthotomus atrogularis nitidus*. Burmese Black-necked Tailorbird.*Previous records*.—None.*Specimens*.—None.*Noted*.—Not uncommon both on Nattaung and at Thandaung, where breeding pairs were observed in May. It is very tame and I have watched a pair at a range of four feet; the sexes are easy to distinguish in the field and the trilling call-note *kri-kri-kri-*, repeated a varying number of times, is quite distinctive.827. *Franklinia gracilis hodgsoni*. Franklin's Wren-Warbler.*Previous records*.—Karenni (Wardlaw Ramsay).*Specimens*.—None this year.*Noted*.—Franklinias were twice seen at Thandaung, but the species was not distinguished.828. *Franklinia r. rufescens*. Beavan's Wren-Warbler.*Previous records*.—Karen Hills 2,000 feet (Wardlaw Ramsay).*Specimens*.—None.*Noted*.—See under preceding species.

839. **Phragmaticola aedon.** Thick-billed Warbler.

Previous records.—Karen (Wardlaw Ramsay).

Specimens.—Thandaung 1♀.

Noted.—Several birds arrived in Thandaung on 8 May on passage, and birds were seen and heard singing up to 12 May, when I left. The song is mainly low in pitch and lacks power, but though thin is not unpleasant.

[*Note.*—Some of the other migrant Warblers may occur in the hills on passage and should be looked for. A small party that I strongly suspect were *Acrocephalus arundinaceus*, but of which I failed to obtain a specimen, was seen in Thandaung on 8 May. A species of *Tribura* has recently been obtained on Mt. Byingye and is likely to occur in our area.]

851. **Phylloscopus schwarzi.** Radde's Willow Warbler.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—Thandaung 1♂, 1♀, 1 o.

Noted.—It probably winters in the tea estate and was very common there in March; birds on passage were noted in April-May, the last on 9 May, and the first specimen was obtained on 3 November. It resembles *P. fuscatus* in habits and makes a *tschik tschik* note in bushes, but is easily recognised by plumage.

864. **Phylloscopus p. pulcher.** Nepal Orange-barred Willow Warbler.

Previous records.—Karen, 3,000 feet (Wardlaw Ramsay).

Specimens.—None this year.

Noted.—Scarce and confined to the higher slopes of Nattaung.

871. **Phylloscopus i. inornatus.** Crowned Willow Warbler.

Previous records.—None before 1939?

Specimens.—Nattaung 1♂.

Noted.—Common and probably winters all through these hills.

871. **Phylloscopus proregulus chloronotus.** La Touche's Yunnan Willow Warbler.

Previous records.—Taho (Salvadori); pine forests near papun (Davison).

Specimens.—None.

Noted.—Not seen by us.

863. **Phylloscopus m. maculipennis.** Grey-faced Willow Warbler.

Previous records.—None nearer than Mt. Victoria and North-East Burma.

Specimens.—Nattaung 2♀, 1 o.

Noted.—Found only on Sosiko, 7,000-7,500 feet. It is easily recognised by small size, intense activity, and grey head contrasting with olive-green back and yellow rump. Those observed were working through the undergrowth in evergreen at 3 to 6 feet from the ground. No evidence of breeding was obtained.

[878. **Phylloscopus magnirostris.** Large-billed Willow Warbler.

Davison obtained it at Thaton, and it is not unlikely to occur in the hills on passage though there is no record so far. The dark tip to the lower mandible is probably the best field distinction from the next species.]

880. **Phylloscopus t. trochiloides.** Dull Green Willow Warbler.

Previous records.—None?

Specimens.—Thandaung 2♂ (25-9-39) and (7-5-40), 1♀ (28-4-40).

Noted.—Probably winters in small numbers.

876. **Phylloscopus trochiloides plumbeiceps.** Middendorff's Willow Warbler.

Previous records.—None.

Specimens.—Thandaung 2♂ (25-9-39).

Noted.—These two specimens were the only birds seen, and must have been on passage.

[879. **Phylloscopus terellipes**. Pale-legged Willow Warbler.

We did not meet with this species, which Davison obtained at Kyaukhnyat and which probably occurs in the hills on passage.]

884. **Phylloscopus reguloides assamensis**. Baker's Willow Warbler.

Previous records.—None before 1939?

Specimens.—Nattaung 2♂, 2♀.

Noted.—A male was shot off a nest on the top of Sosiko, 7,500 feet, on the edge of temperate forest. The nest was compactly made of moss and was built on the ground under a tuft of grass, and contained 3 young, just ready to leave. Another nest, containing 2 young of about the same age, was found on a hillside under a tuft of grass; it was made entirely of moss of a felt-like texture, and had a dome of moss. The note of this bird is difficult to describe: *pit-chew-a-pit-chew-a-pit-chew-a...* the three notes slurred into each other to produce a continuous undulating wave of sound; the alarm-note is *zip-aye... zip-aye*, or *cheep-it...cheep-it*. Not collected at Thandaung but probably resident there also.

886. **Phylloscopus reguloides claudiae**. Pallas's Himalayan Willow Warbler.

Previous records.—None before 1939?

Specimens.—None this year.

Noted.—We were unable to detect any difference in the call-notes of *assamensis*, *claudiae*, and *davisoni*. All three are typical leaf *Phylloscopi*, frequenting the canopy and occasionally the understorey.

885. **Phylloscopus d. davisoni**. Tenasserim White-tailed Willow Warbler.

Previous records.—Thandaung, breeding (Cook).

Specimens.—Nattaung 1♂, 1♀, 1♂; Thandaung 1♀.

Noted.—Common.

[895. **Phylloscopus cantator**. Tickell's Willow Warbler.

Wardlaw Ramsay obtained it in the Karen Hills near Toungoo (elevation?), but we have not met with it east of the Sittang.]

890. **Seicercus burkii tephrocephalus**. Anderson's Flycatcher-Warbler.

Previous records.—Karen Hills (Wardlaw Ramsay); Taho (Salvadori).

Specimens.—Thandaung 1♂.

Noted.—Not uncommon both on Nattaung and at Thandaung. It keeps to dense bamboo thickets and undergrowth, and often associates with *Stachyris chrysaea*. It has a *chip-chip* call-note. It was observed from September to mid-April, but none was seen after 24 April, and it either becomes very secretive in the breeding season or else migrates. It is known to breed in the Chin Hills and North-East Burma and probably breeds in the Shan States; proof that it breeds in our area would be of interest.

896. **Abroscopus s. superciliaris**. Yellow-bellied Flycatcher-Warbler.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 2♂, 1♀; Thandaung 1♂.

Noted.—Common both on Nattaung and at Thandaung up to 4,500 feet in *ponzo*, bamboo and wet thickets.

910. **Homochlamys fortipes** subsp. Strong-footed Bush Warbler.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♀; according to Dr. Ticehurst this specimen probably represents a new race.

Noted.—The only bird seen was skulking in long grass beside the Mawchi road at 4,500 feet and uttering a call-note like that of *Muscicapa parva* cursive-tailed. In the field it looks a small dark brown bird with a buff supercilium.

913. *Homochlamys p. pallidipes*. Blanford's Bush Warbler.*Previous records*.—Karen Hills (Wardlaw Ramsay); Papun (Davison).*Specimens*.—None.*Noted*.—Not seen by us.922. *Phylloscophus cucullatus coronatus*. Golden-headed Warbler.*Previous records*.—Karen Hills (Wardlaw Ramsay).*Specimens*.—None this year.

Noted.—It is common both on Nattaung and at Thandaung, but keeps low down in dense bamboo thickets; one may wait half an hour or more close to a party calling busily without getting even a glimpse of a single bird. The call-note, not very well described in our previous notes, is most distinctive: a four note whistle, the first two notes on the same pitch, the third a trill (of 3 to 4 notes uttered very quickly) and the fourth is either higher or lower in pitch than the first two. This call is repeated in a remarkable number of keys, high and low. Like *Abroscopus* it occasionally climbs 20 or 30 feet up a tall bamboo when feeding.

930. *Suya s. superciliaris*. Anderson's Hill Warbler.*Previous records*.—Karen Hills (Wardlaw Ramsay), Thandaung, breeding (Cook).*Specimens*.—Nattaung 2 ♂, Thandaung 1 ♂ (30-4-41).

Noted.—It is a common resident, both in the grassy undergrowth of the pine forests on Nattaung and in the grassy *ponzo* in the tea estate at Thandaung. Its song, *chwee-chwee-chwee*, 25 times in 10 seconds, is uttered from the top of a bush or tall reed and closely resembles the song of *Orthotomus sutorius palia*, though no doubt differences in volume and pitch would be noticeable if the two were heard calling together. Its call-note resembles the song but is louder, slower, and higher in pitch *pee-up, pee-up, pee-up, . . .* Its alarm-note is a continuous reel, uttered by both birds at the nest.

950. *Irena puella sikkimensis*. Fairy Bluebird.*Previous records*.—Western slopes of the Karen Hills (Wardlaw Ramsay).*Specimens*.—None.

Noted.—A bird is usually to be seen on the road up to Thandaung, and on 26 September a party of 4 was seen at 2,500 feet; it is mainly a bird of the foothills and probably seldom exceeds 3,000 feet. It is confined to evergreen and was not seen on Nattaung.

955. *Oriolus chinensis tenuirostris*. Burmese Black-naped Oriole.*Previous records*.—Karen (Wardlaw Ramsay).*Specimens*.—Thandaung 1 ♂, immature.

Noted.—Not uncommon. The race *diffusus* has been recorded from Thaton (Davison) and probably occurs in our area.

958. *Oriolus x. xanthornus*. Indian Black-headed Oriole.*Previous records*.—Karen (Wardlaw Ramsay).*Specimens*.—None.*Noted*.—None seen by us; evidently scarce above 3,000 feet.961. *Oriolus t. traillii*. Maroon Oriole.*Previous records*.—Karen Hills and Karen (Wardlaw Ramsay).*Specimens*.—Nattaung 1 ♀.

Noted.—It is not uncommon on Nattaung and frequents both evergreen and the more open parts along the Mawchi road, where the specimen was obtained. A bird was observed carrying food in its bill on 21 April. The notes are similar to those of *chinensis*, but rarely heard. Seen occasionally at Thandaung.

[964. *Gracula intermedia religiosa*. Indian Grackle.

There seem to be no records from the area; if it occurs it is probably confined to the foothills.]

970. *Saroglossa s. spiloptera*. Spotted-winged Stare.

Previous records.—‘Tolerably abundant on the thickly wooded slopes of the Karen Hills’ (Wardlaw Ramsay).

Specimens.—None.

Noted.—Not seen by us; as all the Burma records are between December and February we may have been too late for it.

Mynas. We saw none. Wardlaw Ramsay obtained in Karen, Jerdon’s Myna (*G. burmanica*) and the Siamese Jungle Myna (*Aethiopsar griseus grandis*), the latter at 3,000 feet. Mawchi, which we did not visit, is a likely place for them.

1024. *Uroloncha striata acuticauda*. Hodgson’s Munia.

Previous records.—Karen Hills (Wardlaw Ramsay and Salvadori).

Specimens.—Nattaung 1♂.

Noted.—A few parties were seen in the growth beside streams running through *taungyas*, and once at 5,500 feet in pine forest. In Thandaung they are common in large parties all round the tea estate, and are probably the birds recorded by Cook as *punctulata*, which we did not see. A pair was observed building a nest on 12 May.

[1037. *Amandava a. flavidiventris*. Burmese Red Munia.

Obtained by Wardlaw Ramsay in Karen, elevation not stated. It is unlikely to occur above 3,000 feet.]

1069. *Carpodacus erythrinus roseatus*. Hodgson’s Rose Finch.

Previous records.—Karen Hills (Wardlaw Ramsay and Salvadori).

Specimens.—Nattaung 1♀.

Noted.—Cook obtained one from the lower hills below Thandaung, but we have not seen it there.

1090. *Hypacanthis spinoides ambiguus*. Yunnan Green Finch.

Previous records.—None.

Specimens.—Nattaung 1♀, 1♂.

Noted.—Not seen at Thandaung and probably absent. It is common in the pine forests of Nattaung, in which it keeps mainly to the tree tops and frequently perches on the topmost point of small pines. The broad yellow band from base to tip of wing, dividing it into three roughly equal parts, is diagnostic in flight and the blackish head when perched. The call, freely uttered, is a thin metallic tinkle and quite distinctive.

1107. *Passer rutilans* subsp. Cinnamon Sparrow.

Previous records.—Karen (Wardlaw Ramsay).

Specimens.—Nattaung 2♂, too worn to determine subspecifically.

Noted.—Not seen at Thandaung. The specimens were obtained from isolated trees in *taungyas*, and one of them was singing something like *chwe-cha-cha* repeated over and over, a thin but pleasant song. One other male was seen but no females, which were probably sitting.

1108. *Passer flaveolus*. Pegu House Sparrow.

Previous records.—Karen (Wardlaw Ramsay).

Specimens.—None.

Noted.—Not seen by us; may not occur above 3,000 feet.

(*Note*.—We saw no ‘house Sparrows’ (*P. domesticus* & *P. montanus*) but they may occur at Mawchi.)

1120. *Emberiza f. fucata*. Grey-headed Bunting.

Previous records.—Yado (Salvadori).

Specimens.—None.

Noted.—Not seen by us.

1122. *Emberiza pusilla*. Little Bunting.

Previous records.—Karenini (Wardlaw Ramsay); Yado (Salvadori).

Specimens.—None.

Noted.—Not seen by us. Possibly it migrates early.

1131. *Emberiza aureola*. Yellow-breasted Bunting.

Previous records.—Taho (Salvadori).

Specimens.—Thandaung 1♂, 1♀.

Noted.—The specimens were obtained at Thandaung in the tea estate on 28 April and 9 May, the male being one of a pair and the other a solitary bird. It does not winter at Thandaung, and these birds were passage migrants.

1135. *Emberiza rutila*. Chestnut Bunting.

Previous records.—Described by Wardlaw Ramsay as the common Bunting of the higher Karen Hills, and recorded by Salvadori from Yado. Cook obtained one at Thandaung in April.

Specimens.—None.

Noted.—The only bird seen was a male on 20 March at 4,200 feet in Thandaung, in undergrowth at the edge of a small clearing. It seems to be more of a forest bird than other Buntings, and possibly migrates early.

1139. *Melophus lathami subcripsata*. Crested Bunting.

Previous records.—Described by Wardlaw Ramsay as 'by far the commonest Bunting in the Karenne country, where the rocky scrub-covered hill-sides seem to suit it. It is particularly fond of the neighbourhood of tiny streams covered with bushes in open country. Their note, which is uttered on the wing, is a rather pleasing whistle quite unlike that of any other Bunting.' Apparently he did not find it over 3,000 feet. Recorded from Yado by Salvadori.

Specimens.—None.

Noted.—It is curious that we did not meet with this bird at all.

1143. *Martula urbica whiteleyi*. Siberian House Martin.

Previous records.—None.

Specimens.—Nattaung 1♀.

Noted.—As Stanford has commented (*Ibis*, Oct. 1938 p. 622) on the lack of authentic records of House Martins, the following notes may be of interest:—

A party of House Martins, either *M. u. whiteleyi* or *M. dasypus cashmeriensis*, was observed hawking insects over the summit of the Kambili Taung, 2,634 feet; this hill is in the Tharrawaddy district (Zigon forest division) a few hundred yards off the main Pegu Yoma ridge (Irrawaddy-Sittang divide), and is the second highest hill in the Pegu Yomas. The House Martins were in company with a large flock of White-rumped Swifts, and appeared little more than half their size. This was on 13 December 1935, but when I climbed the same hill on 7 December 1937 there were no House Martins.

A party of *M. d. cashmeriensis* (1♂ obtained and sent home to Dr. Ticehurst but unfortunately lost in transit) was observed hawking insects over the summit of a 5,208 foot peak in the Arakan Yomas close to the main Yoma ridge (Irrawaddy-Bay of Bengal divide); the summit is on the boundary between the Thayetmyo and Minbu districts, and is one of the few peaks in these hills with a bare grassy top. The birds were seen on 4 and 5 December 1938.

A large flock of House Martins was seen on Nattaung last year, but no specimen was obtained (vide our previous paper).

On Nattaung this year large flocks, totalling hundreds of birds were seen almost daily throughout our visit, and the specimen obtained was *M. u. whiteleyi*; they appeared at about 8 a.m. and hawked insects through the heat of the day over the pine forest, especially where the trees had been felled and the ridges and knolls were bare, until the early afternoon, when they disappeared.

Finally a large flock appeared in Thandaung on 29 April, but was not seen again.

It seems therefore that the Siberian House Martin is a regular winter visitor in comparatively large numbers, arriving early in November (when Livesey saw them at Taunggyi) and leaving in early May, and that it has been overlooked in the past only because it spends the winter over inaccessible

Noted.—Rather scarce; in Thandaung it was seen only in November and March, and on Nattaung two or three times. It seems to prefer fairly open scrub and bushes bordering streams, and has twice been seen just below the top of Thandaung-gyi.

1273. *Aethopyga s. sanguinipectus*. Walden's Yellow-backed Sunbird.

Previous records.—Karen Hills; Karen (type locality, Wardlaw Ramsay).

Specimens.—Nattaung 2♂; Thandaung 1♂, 1♀.

Noted.—Fairly common up to 5,000 feet. It keeps mainly to evergreen and is very partial to streams running through this type of forest, where I have often seen them feeding along the bushes on the banks in the middle of the day. It also visits the more open country.

1276a. *Aethopyga nipalensis karenensis*. Nattaung Sunbird.

Previous records.—None before 1939.

Specimens.—None this year.

Noted.—This appears to be confined to the Pine-Rhododendron association and temperate forest on the higher slopes of Nattaung, it is common there, but none was seen below 7,000 feet.

1279. *Cinnyris asiatica intermedia*. Burmese Purple Sunbird.

Previous records.—Karen (Wardlaw Ramsay).

Specimens.—None.

Noted.—Not seen by us. May not occur above 3,000 feet.

1293 *Arachnothera m. magna*. Indian Streaked Spiderhunter.

1294. *Arachnothera m. aurata*. Pegu Streaked Spiderhunter

Previous records.—Karen Hills (Wardlaw Ramsay); Thandaung (Cook).

Specimens.—Thandaung 1♀ (nearest *aurata*), the specimen obtained last year on Nattaung was *magna*.

Noted.—The two races evidently intergrade in the Karen Hills. The bird is not uncommon and there seemed to be an influx at the end of April into Thandaung.

1296 *Arachnothera l. longirostra*. Little Spiderhunter.

Previous records.—Thandaung (Cook).

Specimens.—None.

Noted.—Scarce. Only observed in the tea estate at Thandaung in October, April and May. The flight is direct and strong, and a bleating note is uttered on the wing.

1298-9. *Dicaeum cruentatum* subsp. Scarlet-backed Flowerpecker.

Previous records.—None.

Specimens.—None.

Noted.—Although it is common in Toungoo town we have seen only one in the hills, on 2 November at Thandaung.

1300. *Dicaeum trigonostigma rubropygium*. Tenasserim Orange-bellied Flower-pecker.

Previous records.—Karen Hills 3,000 feet (Wardlaw Ramsay).

Specimens.—None.

Noted.—Not seen by us.

1302. *Dicaeum chrysorrheum chrysochlora*. Burmese Yellow-vented Flower-pecker.

Previous records.—Karen Hills (common at 3,000 feet, F.B.I.).

Specimens.—None.

Noted.—Except for a pair in the tea estate on 10 May we saw none, and it must be either local or a bird of the foothills.

1303. *Dicaeum l. ignipictus*. Fire-breasted Flowerpecker.*Previous records*.—Karenni.*Specimens*.—Thandaung 1♂, 1♀.

Noted.—This is the typical Flowerpecker of the area; it keeps to the tree-tops and would escape observation but for its clicking note on the wing. I have seen a male utter a long continuous series of clicks from a perch, while swaying his body from side to side.

1306. *Dicaeum concolor olivaceum*. Plain-coloured Flowerpecker.*Previous records*.—Karen Hills, type locality (Wardlaw Ramsay).*Specimens*.—None.*Noted*.—Not seen by us.[1312. *Piprisoma m. modestum*.

It has been recorded from the Southern Shan States, Tenasserim, and the Pegu Yomas in the Toungoo district, though not as yet from our area, in which it seems likely to occur.].

1316. *Anthocincia phayrei*. Phayre's Pitta.

Previous records.—This bird was first obtained in the Toungoo district, 'probably in the higher hills to the east of the Sittang river'. The F.B.I. states that Bingham found a nest at about 5,000 feet in the Karen Hills, whereas he actually found it near a Karen village in the Dawnas (Meple valley, Northern Tenasserim).

Specimens.—None.*Noted*.—Not seen by us.1318. *Pitta oatesi*. Fulvous Pitta.

Previous records.—Karenni 2,500-4,000 feet (Wardlaw Ramsay); Taho (Salvadori).

Specimens.—Nattaung 1♀.

Noted.—This, the only bird seen, was in the bed of a stream running through evergreen at 3,500 feet on Nattaung, and was obtained at about 2 p.m.

1320. *Pitta c. cyanea*. Blue Pitta.*Previous records*.—Karen Hills (Wardlaw Ramsay).*Specimens*.—Thandaung 1♂.

Noted.—A bird was given alive and apparently uninjured by a Karen to the durwan of the Circuit House, but it died a few days afterwards and the corpse was presented to me on 22 October; seen once or twice near Pathichaung at about 500 feet.

[1321. *Pitta moluccensis*. Lesser Blue-winged Pitta.

The F.B.I. gives this from the Karen Hills, based on Hume's loose statement that it breeds from Arakan to Karenni; all specimens and records indicate that it is a low elevation species.].

[1325. *Pitta c. cucullata*. Green-breasted Pitta.

A Pitta seen on the Leiktho mule path, the upper-parts of which appeared very dark as it hopped off into the bamboo thickets below, must have belonged to this species; it was certainly not *P. moluccensis*, *P. c. cyanea*, or *P. oatesi*.]

[1328. *Eurylaimus javanicus*. Horsfield's Broadbill.

Lloyd is said to have obtained it in the Toungoo hills, and the F.B.I. gives it from Karenni, but proof of its occurrence is desirable.].

1330. *Corydon sumatranaus*. Dusky Broadbill.*Previous records*.—Karen Hills (Wardlaw Ramsay)*Specimens*.—None.

Noted.—Except for a bird seen in a tree-top beside the Leiktho mule path at 3,500 feet we have not met with this bird. The broad reddish bill and red orbital skin contrasting with the black* head are diagnostic.

1333. *Serilophus l. lunatus*. Gould's Broadbill.

Previous records.—Karen 3,000-4,000 (Wardlaw Ramsay). Karen Hills, Taho (Salvadori).

Specimens.—None.

Noted.—Not seen by us.

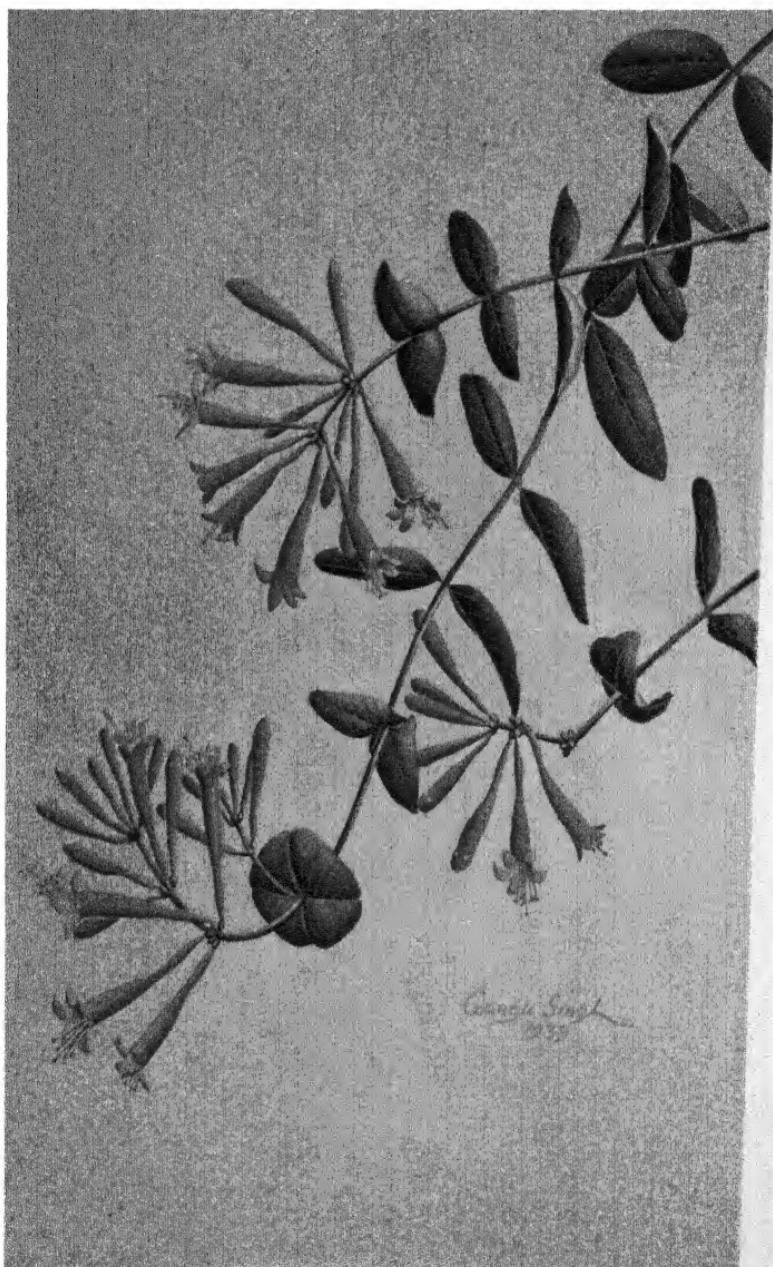
1335. *Psarisomus dalhousiae*. Long-tailed Broadbill.

Previous records.—Karen Hills (Wardlaw Ramsay); Yado (Salvadori).

Specimens.—Nattaung 1♂, 1♀.

Noted.—Fairly common, both on Nattaung and at Thandaung; it keeps mainly to evergreen, but we have noted it in high regrowth. The call is a loud piercing whistle of 5 to 8 notes with little if any change in pitch; it occasionally utters a single *weet* note. A pair was observed building a nest on 15 April. The nest was quite typical, suspended from the tip of a branch overhanging a stream where the pine forest merged into evergreen.

(To be continued)



The Trumpet Honey-suckle
LONICERA SEMPERVIRENS Linn.
(Nat size.)

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

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PART XIV

(Continued from Vol. xliii, No. 4 (1943), p. 552).

(With 1 coloured and 2 black and white plates, and 3 text-figures).

Lonicera Linn.

The Honeysuckle or Woodbine.

(A genus named in honour of Adam Lonitzer, Professor of Medicine in Mainz, 1528-86).

Lonicera L. is a genus of the family *Coprifoliaceae* and comprises about 160 species which are distributed in the sub-tropical and temperate regions of the northern hemisphere, from the arctic circle southwards to the Malayan Archipelago, Southern Asia, North Africa, Madeira and Mexico.

Characters of the genus.—Upright to twining, rarely creeping shrubs. Stems glabrous or hairy, often glandular, with fistulose (hollow) or solid branches. The leaves are opposite, petioled or sessile and often with opposite pairs connate at the base. Stipules usually opposite, but occasionally interpetiolar stipules are present. Flowers white or yellow, purple or scarlet, usually arranged in simple cymes which are 2-flowered by the suppression of the middle flower, or three-flowered, and sessile or whorled and collected in terminal spikes or panicles. Individual flowers subtended by bracts and bracteoles. Calyx tube short, adnate to the ovary, ovoid or sub-globose with a short, 5-toothed limb. The corolla is tubular to funnel-form or sometimes campanulate with a regular five-lobed limb or 2-lipped, in which case the upper lip is 4-lobed; lobes long or short, imbricate in the bud. Stamens five, inserted in the tube, usually near the mouth, usually exserted. Ovary inferior, 2- to 3-celled; each cell with 3-8 ovules pendulous from the inner angles. Style elongated, with a capitate stigma, usually exserted from the

tube. Fruit a red or yellow berry, few-seeded. The receptacle at the base of the corolla tube secretes a nectar. Cross-fertilisation is accomplished by insects which come to take the nectar.

Before we show how this cross-fertilisation takes place we shall describe the mechanism of a typical specimen of the genus, *Lonicera periclymenum* L., a European species.

Just before the erect flower buds open the stigma is receptive and the anthers have already dehisced. The pollen is sticky and as the stigma stands some distance above the anthers, self fertilisation is avoided (A.). When the bud opens the flower sinks through an angle of 90° so that it comes to rest in a horizontal position. The positions of the stamens and style are shown in Fig. B. The style

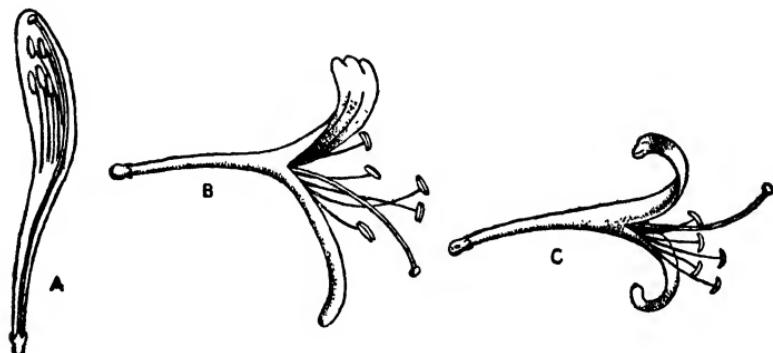


Fig. 1.—Pollination in *Lonicera periclymenum* Linn. after Kurth $\times \frac{3}{4}$.

is well out of the way below the stamens whose dehisced anthers are turned upwards. Any insect visitor which now comes to get nectar from the flower is bound to touch the dehisced stamens and carry away pollen on its under surface. After pollen has been removed the filaments wither and sink down. The style at the same time curves upwards and comes to occupy the position indicated in C. It is obvious that in this state of the flower it is the stigma and not the stamens which will touch the undersurface of an insect-visitor. In stage B the flowers are large and brightly coloured; in stage C they have become smaller and duller.

The process of cross fertilisation is as follows:—On any plant of *L. periclymenum* there will be found flowers in all stages of development from the bud to the fading fertilised bloom. When the bud opens an attractive scent is emitted and the flower itself is fresh and brightly coloured. Hence insects (hawk-moths) visit these flowers, which are in stage A, first. From the relative positions of stamens and style it is certain that the visitor will carry away quantities of pollen. In stage B, the flower has faded and the scent is not so strong, therefore these flowers are visited later, and as may be seen from fig. C. it is the stigma this time which must touch the insect. In this way cross-fertilisation is ensured.

The Loniceras are deservedly popular on account of the fragrant pretty flowers and handsome foliage.

KEY TO THE SPECIES.

Leaves connate	... <i>L. sempervirens</i> .
Leaves distinct.	
Bracts subulate; ovary hairy; leaves and flowers larger.	... <i>L. confusa</i> .
Bracts ovate, leafy; ovary glabrous; leaves and flowers smaller.	.. <i>L. japonica</i> .

Lonicera sempervirens Linn.

The Trumpet Honeysuckle.

(*sempervirens* means evergreen in Latin).

Description.—An extensively climbing, glabrous, woody twiner. Leaves oblong or ovate, rounded at the tips, wedge-shaped or rounded below, opposite, exstipulate, glossy, green on the upper surface, covered with a white bloom below. 2-3 in. long. The upper one or two pairs of leaves are connate by their bases.

Inflorescence a terminal, interrupted spike, the individual flowers being whorled in groups of 4-6, supported by bracts and bracteoles. Calyx adnate to the ovary ending above in five, short, blunt teeth. Corolla tube, 1-2 in. long, seated on top of the ovary slightly ventricose, glabrous outside, sparsely pubescent with white hairs within, scarlet, orange or sometimes yellow on the outer surface, yellow within, five-lobed; lobes reflexed. On the inner surface near the base is an oval-shaped area which is slightly thicker than the rest of the corolla and is covered with stalk-like glands.

Stamens five inserted on the tube below the mouth, alternate with the lobes. Ovary inferior, 2-3 celled. Fruit a red berry. The flowers of this species are not fragrant.

Flowers.—February-March. Does not fruit in this country.

Distribution.—Indigenous to Southern United States. Cultivated in gardens in the plains.

Gardening.—A beautiful twiner when in full bloom with its scarlet, though scentless flowers. It is best adapted for a trellis or pergola. It is a common twiner in English gardens and is readily propagated by layers.

Lonicera confusa DC.

(*confusa* means confused or uncertain in Latin, and refers to the fact that this plant has often been mistaken for a closely allied species, *L. japonica* Thunb.).

Description.—An extensively climbing, hairy species. Stems cylindrical, fistulose, covered with short, dense, brownish hairs. Leaves opposite, ovate-lanceolate in shape rounded at the base, petioled, 2-3 in. long, rather rough, glabrous or sparsely hairy on the upper surface, ciliate on the margins, softly and shortly hairy on the prominent nerves and reticulation of the under surface.

Flowers in axillary, pedunculate pairs, or collected into terminal panicles or spikes of whorled pairs. Pairs of flowers supported by

subulate, hairy bracteoles. Calyx adnate to the ovary, very hairy, ending in five subulate hairy teeth. Corolla 1 in. long, two-lipped, softly and shortly hairy within and without, white fading to yellow;

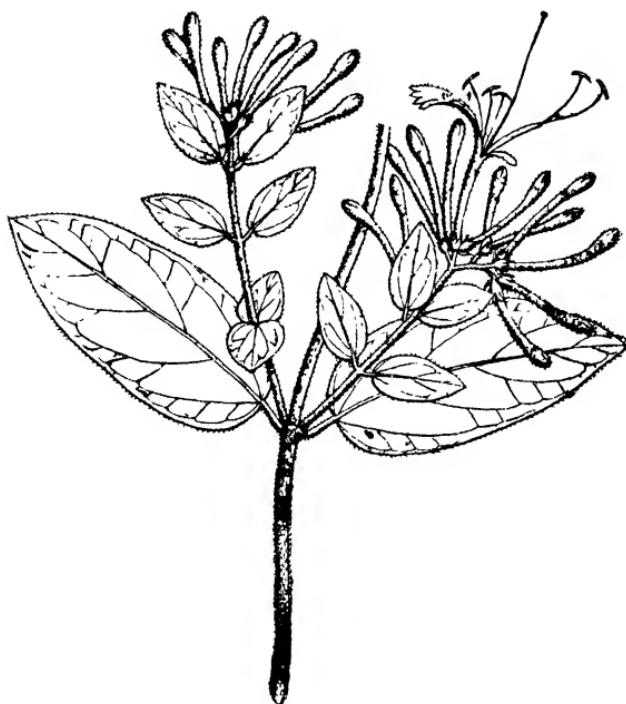


Fig. 2.—*Lonicera confusa* Dc. $\times \frac{3}{4}$.

tube as long as the lips; upper lip 4-, the lower 1-lobed. Stamens five, alternate with the lobes of the corolla, long exserted. Style long, filiform. Ovary inferior.

Distribution.—Found wild in China, Java and Borneo. Cultivated in the plains and hills.

Flowers.—March-April. Does not fruit in this country.

Gardening.—An evergreen twining shrub similar to *L. japonica*. The flowers, at first white, afterwards fading to yellow, are produced in March and are quite effective. It is suitable for growing over an arch or trellis. Propagation is by cuttings or layers during the rains.

***Lonicera japonica* Thunb.**

Japanese Honeysuckle.

(The specific epithet indicates the origin of Thunberg's specimen).

Description.—A widely climbing twiner. Stems glandular-hairy, fistulose, cylindrical. Leaves opposite, petioled; ovate to oblong-ovate, $1\frac{3}{4}$ -2 in. long, rounded at the base, acute or obtuse at the tip, glabrous or sparsely hairy on the upper surface, glabrous or

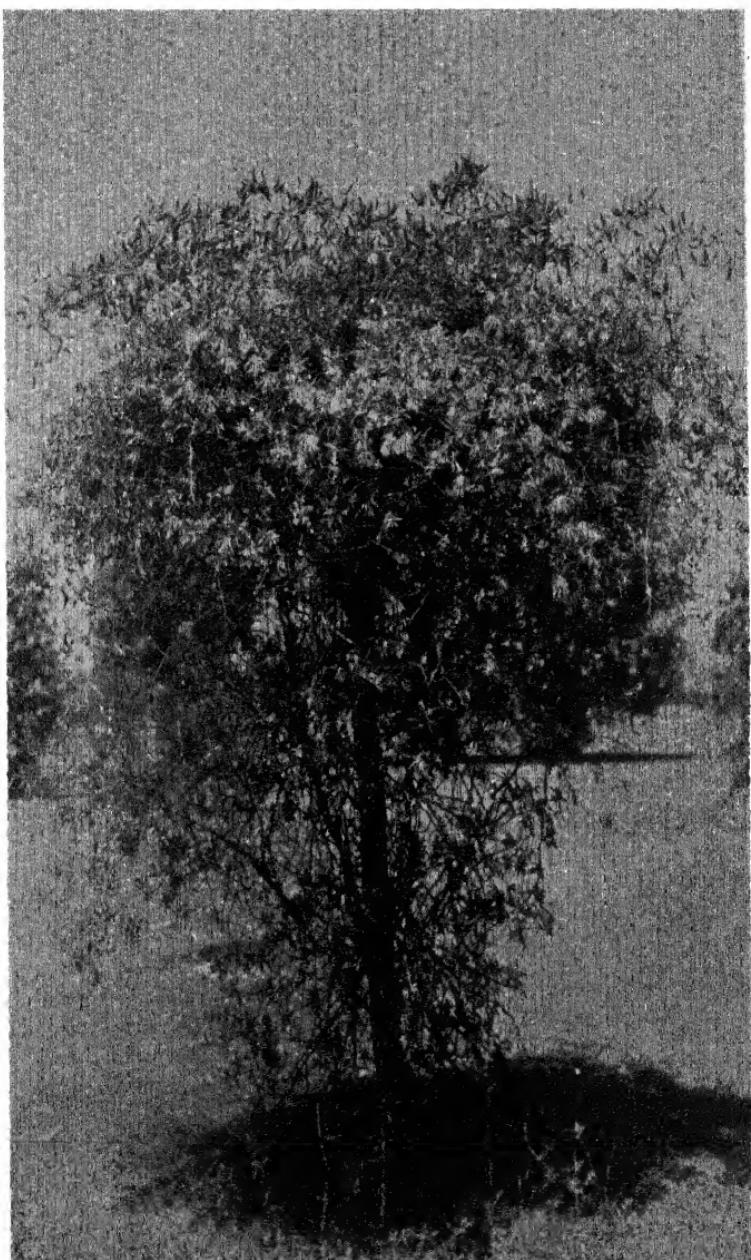


Photo by

M. N. Bakshi

Lonicera sempervirens Linn.

New Forest, Dehra Dun.

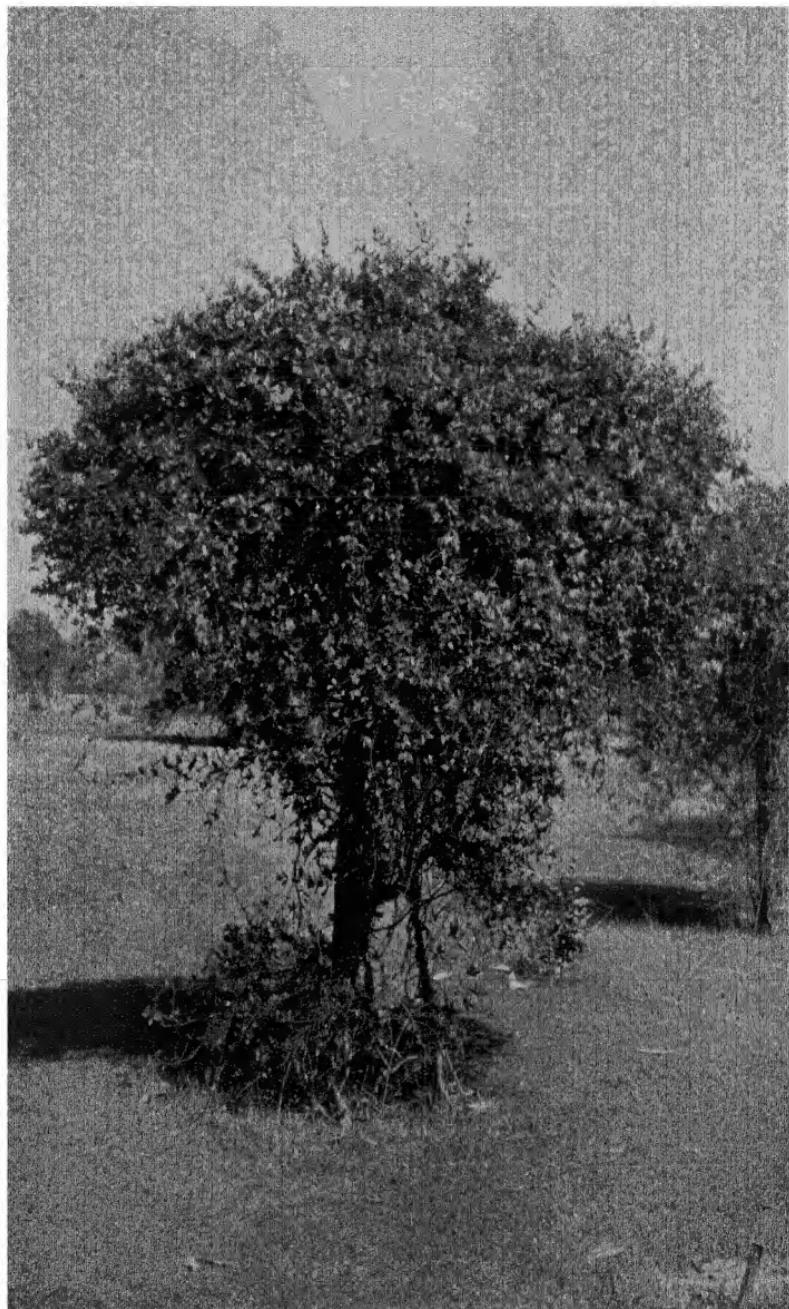
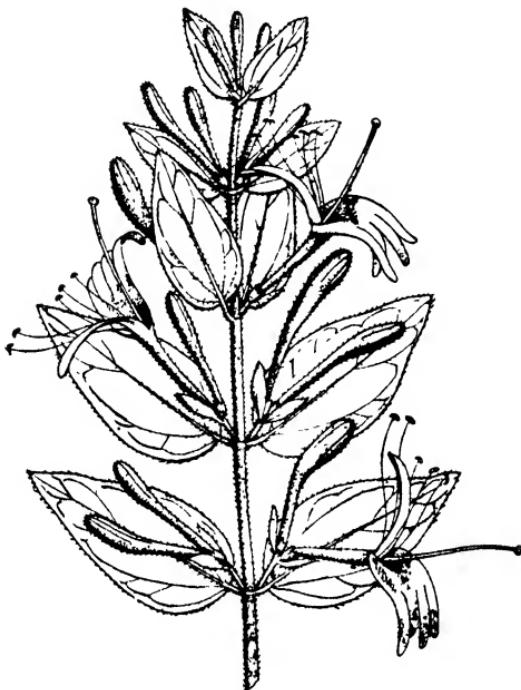


Photo by

Lonicera japonica Thunb.
New Forest, Dehra Dun.

M. N. Bakshi

softly hairy on the under surface, ciliate on the margins; petiole $\frac{1}{4}$ in. long, covered with soft yellow hairs



• Fig. 3—*Lonicera japonica* Thunb. $\times \frac{3}{4}$.

Inflorescence similar to that of *L. confusa*. The bracts are, however, foliaceous, instead of subulate, in shape. The corolla is somewhat larger and is hairy and glandular without. The calyx is glabrous.

Flowers.—Cold season. Does not set seed in this country.

Distribution.—Indigenous to China, Japan and Formosa, now commonly grown in gardens in the plains and hill stations.

Gardening.—An evergreen twiner with white red or purple tinged flowers which are very fragrant. It is suitable for trellis work and grows readily from cuttings and layers. The form commonly cultivated in gardens is var. *chinensis*.

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

PART XI

(Continued from Vol. xliii, No. 3 (1942), p. 415).

RHOPALOCERA

PAPILIONIDAE

Chilasa clytia L., *clytia*

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 393. 1938.

Talbot, *Fauna Brit. Ind.*, Butterflies (2nd edit.), i, 115, pl. 1, figs. 5, 6. 1939.

I have bred this species yearly since 1931, and all larvae have been of the black and cream form first described. This year (1942) all larvae found have had the normally black areas an olivaceous grey dotted with black, not unlike Talbot's figure referred to above, but with the spots larger and fewer. I am unable to account for this sudden change of form.

Talbot, quoting Bell, gives the following description:—‘Velvety black or dark green, with a dorso-lateral row of carmine circular spots. A creamy dorsal band on segments 3 to $7\frac{1}{2}$, narrowing at both ends and flanked by a broad, lateral, similarly coloured band; also a broad creamy band on segments 11 to 14 externally. Two lateral rows of sharp spines on segments 1 to 4, and a single row on the other segments. Osmeterium a light watery indigo-blue. Length 55 mm.’ This description is incorrect in several details—the spines are subdorsal not lateral, the cream bands are wrongly placed, and there are three rows of carmine spots instead of one.

My original description contains an error. It is the lower lateral series of spots that is complete from the 4th to 11th somite, the upper series has spots on the 3rd, 4th, 5th, 7th, 8th and 9th somites only.

Papilio polytes L., *romulus* Cr.

Moore, *Lep. Ceyl.*, i, 150. 1880-81.

Davidson & Aitken, *Journ. Bomb. Nat. Hist. Soc.*, v, 366. 1890.

Bingham, *Fauna Brit. Ind.*, Butterflies, ii, 62. 1907.

Jordan, *Seitz Indo-Austr. Rhop.*, ix, 61. 1909.

Talbot, *Fauna Brit. Ind.*, Butterflies (2nd edit.), i, 177, pl. 1, figs. 18a, 18b, 19. 1939.

Immature larva—Head brown. Body dark olive brown, in some examples almost chocolate, with a diffused white lateral stripe on the thoracic somites, a white V-shaped mark, starting laterally on

the 5th somite with the arms joining dorsally on the 8th, and a broad white lateral band on the 10th and 11th somites with a transverse bar across the dorsum of the 12th. A white sublateral line from the 6th somite backwards. 1st somite with a black-tipped, yellowish subdorsal spine. 2nd and 3rd somites with a transverse series of six very short blunt tubercles, barely visible without a lens. 5th somite with a similar lateral tubercle and a dorsal series of four, the centre two in front of the others. 6th to 10th somites each with a similarly placed dorsal series of four. 11th somite with a dorsal pair of slightly larger, pointed, white tubercles. 12th somite with a dorsal pair of still larger tubercles. 4th somite rather swollen. Osmeterium dark purple. Legs brownish. Prolegs greyish white.

Full grown larva similar to that of *Papilio demoleus* L. (1939, inhi, *Journ. Bomb. Nat. Hist. Soc.*, xli, 311) except that the osmeterium is more scarlet than orange; the ocellus on the 3rd somite consists of a black spot surmounted by two whitish dots and surrounded by a yellowish green ring; the line joining the two ocelli is composed of black-ringed yellowish spots; instead of the fawn transverse stripe on the 4th somite there is a very sinuous white line edged behind by an olive green stripe; the subdorsal spines on the 11th somite very much smaller and whitish.

Pupa suspended by a girdle and tail pad of greyish silk. Head bifid, the horns rather longer than in *P. demoleus*, thorax keeled, the keel forming a short forward-pointing horn, the wing cases protruding, abdomen angled at base so that the thorax is bent backwards, three pairs of small subdorsal spines on the abdomen, the hindmost pair smallest. Colour variable, usually green or mottled brown and grey. The green form with a fawn speck at the base of the wing cases, a bluish-white diffused stripe along their upper edge, which continues as a latero-ventral stripe along the abdomen. The anterior portion of the abdomen with a large subdorsal yellow-green triangular mark, with a small red-brown speck at the anterior angle. The brown and grey forms usually with a dark triangular mark on the wing cases. One specimen formed on white paper had a chalky white dorsal stripe on the apical somites of the abdomen.

Food-plant—*Citrus* spp. and *Aegle marmelos* Correa.

Described from a larva found in Calcutta, pupated 22-viii-42, and a male emerged 1-ix-42.

— Moore's description is as follows:—'Larva smooth, glossy-green much attenuated posteriorly, anterior segments swollen and scutellated, fourth and fifth segments with dorsal transverse cream-coloured fleshy crest, that on the fourth ending on each side in an eye-like spot; a brown-streaked cream-coloured oblique band ascending from the base of seventh segment, and is nearly united with that from the opposite side on back of ninth segment; a similar-coloured broken lateral band on the tenth segment, which is continued round base of anal segment, the latter segment with two small pointed fleshy tubercles. Pupa curved anteriorly; head flattened and slightly bifid, thorax conical in front, abdominal somites with short dorsal tubercles. Colour olive-brown.'

PIERIDAE

Catopsilia crocale Cr.Sevastopulo, *Journ. Bomb. Nat. Hist.*, xl, 394. 1938.Talbot, *Fauna Brit. Ind.*, Butterflies (2nd edit.), i, 491. 1939.

A large number of larvae bred in Calcutta in July 1942 all had the usual black lateral line expanded into a wide dorso-lateral stripe, varying both in width and in depth of colour. In some examples the dorsum was also suffused with blackish.

Whilst not wishing to re-open the controversy of whether *C. crocale* L. and *C. pomona* F. are conspecific or not, it is worth recording that a number of larvae reared from ova found on *Cassia fistula* L., the reputed favourite food-plant of *C. pomona*, in the hope that they would prove to be this species, all turned out to be *crocale*. Also young *crocale* larvae, found on a small plant of one of the pink-flowered Cassias, fed up readily and well on *Cassia fistula*.

HETEROCEA

LYMANTRIIDAE

Caragola ochripes MooreGardner, *Indian Forest Records*, iii, 202, figs. 9, 20, 21. 1938.

Head pale orange. Body with the dorsum pure white, minutely streaked and speckled with black. 1st somite with four crimson tubercles, the outer pair larger and tufted with longish white hair. 2nd and 3rd somites each with six small orange tubercles tufted with short white hair. 4th and 5th somites each with paired dorsal brushes consisting of a ring of short thick rose-pink hair surrounding a dark tubercle with a pale glandular apex. 6th somite with a dorsal tuft of very short white hair and a minute orange wart with a rosette of short white hair. 7th to 9th somites each with two pairs of these orange warts with white hairs. 10th somite with similar warts but the hairs deep yellow. 11th somite with a dorsal tuft of short pale yellow hair. 12th somite deep yellow. A series of sub-lateral yellow tubercles bearing fringes of long white hair, the area below these tubercles pale yellow. Legs and prolegs pale yellow. Venter pale yellow slightly tinged with grey. Dorsal glands yellow.

Pupa under a few netted threads spun across the hollow of a leaf. Ivory white, the dorsum tinged with olive brown. A chestnut patch at the base of the wing case. Dorsum of abdomen, just behind the broadest part, with two pairs of blackish dorsal spots. A tuft of longish pale grey hair from the head, two groups of three long spatulate black hairs from the abdomen just above the wing cases, and another group towards the cremaster. Venter clad with longish white hair. Dorsum of abdomen with three paired tufts of short brownish hair and one of white. Wing cases slightly black-veined.

Food-plant—Gardner gives *Litsea polyantha* Juss., *L. chinensis* Lam. and *Phoebe lanceolata* Nees, all Lauraceae.

Described from a full fed larva found in Shillong 24-iv-41, pupated 13-v-41, and a female emerged 21-v-41.

LASIOCAMPIDAE

Metanastria hyrtaca Cr.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 406. 1938.
Subramanian & Anantanarayanan, *Journ. Bomb. Nat. Hist. Soc.*, xl, 257. 1938.

Ovum almost spherical. Chalky white, the micropyle a dark chocolate-brown spot, and a large dark chocolate-brown spot on either side of the ovum. Laid in small batches.

A fairly powerful hand lens did not reveal the fine sculpturing and the irregular dirty grey faint markings mentioned by Subramanian and Anantanarayanan.

EUPTEROTIDAE

Eupterote undata Blanch.

Head dull black, the clypeus filled in with creamy-white and with a broad creamy-white stripe from apex of clypeus to vertex and extending along the back of the head; a fringe of short, dark golden-brown hair above the mandibles. Body very dark brown, the inter-segmental areas almost black. A subdorsal and sublateral dark pinkish line. Clothed fairly thickly with longish, pale-tipped, dark brown hair, growing in spreading tufts subdorsally, laterally and sublaterally. The dorsal area on the abdominal somites clothed, in addition, with large patches of very short, black-brown hair. Spiracles pinkish. Venter dark brown, not hairy. Legs dark brown. Prolegs yellowish-flesh colour.

Cocoon of dark brown, closely woven, rather papery silk, with an inner cocoon of dark brown silk interwoven with larval hair. Pupa dark mahogany, very shiny, the abdominal somites very minutely punctate. Cremaster closely covered with golden, short, hooked spines. The divisions between the leg, antenna and wing cases not well marked.

Food-plant—*Quisqualis indica* L., *Lantana camara* L., *Alseodaphne semicarpifolia* Nees. and numerous other trees and shrubs. One larva was even found feeding on a coarse, ornamental Grass.

Described from a full fed larva found in Calcutta 16-xi-41, spun 19-xi-41, and a female emerged 29-vi-42.

Eupterote geminata Wlk.

Penultimate instar—Head terra-cotta, a black mark on either side low down and a double black spot just above the clypeus. Body with a broad, pale brown, dorsal stripe with a double, darker, median line, and a broad, blue-grey, dorso-lateral stripe containing two cream lines. A subspiracular cream line. Clothed with long whitish hair. Venter cream with a purplish-black lateral stripe. Legs chestnut. Prolegs pink. Spiracles set in pink patches.

Final instar—Similar to the penultimate, but the pale brown dorsal stripe obscured on the abdominal somites by a coating of short, dark brown, silky hair, and the subspiracular line absent. Lateral area brownish. Head with a wavy pale horizontal line above the lower black marks and below the upper, and with a pale inverted V-shaped mark with its apex on the vertex.

The larvae are 'gregarious, congregating on the trunk and branches of the food-tree in close packed, fury masses by day, and feeding by night. The larvae rest close together, the heads usually pointing in one direction, in slightly curved rows, and may cover an area of two or more square feet. The hairs are extremely irritating and I know of a case where some syces had to desert their usual sleeping place because a tree close by was harbouring these larvae in large numbers.

Pupa in a cocoon of dense greyish-brown silk interwoven with larval hair. Reddish chestnut, the wing cases rather paler. Surface dull, the cuticle densely punctate. The abdominal somites somewhat contracted. Cremaster a fairly long, stout spine armed with a few short bristly hairs.

Food-plant—Various trees and shrubs, among them *Lagerstroemia indica* L.

Described from larva found in Calcutta 19-x-41, one of which spun 26-xi-41, and a female emerged 8-v-42.

SPHINGIDAE.

Theretra pinastrina Mart., *pinastrina*.

Butler, *Proc. Zool. Soc. Lond.*, ix, 560, pl. 92, fig. 8. 1877.

Hamps., *Fauna Brit. Ind.*, Moths, i, 88. 1892.

Mell, *Biol. u. System. der Sudchin. Sphing.*, 310, pl. xi, figs. 12-18 (figs. 18-24), pl. xix, figs. 19-21. 1922.

Seitz, *Seitz Indo-Austr. Bombyces*, x, 567. 1929.

Bell & Scott, *Fauna Brit. Ind.*, Moths, v, pl. vi, figs. 6, 7. 1937.

Ovum—Jade green, of the usual ovoid Sphingid type. Laid singly on the upper or lower surface of a leaf of the food-plant. Hatched 23-viii-42.

1st instar—Head round, green. Body green, at the end of the instar with a yellowish white subdorsal line only visible under a lens. Horn shorter than in most first instar Chaerocampid larvae, straight, black, the base reddish-orange, the tip slightly bifid. Moulted 25-viii-42.

2nd instar—Similar but with a minute black dot on the subdorsal line on somites 4 to 9, the spot placed about one-third of the somite's length from the anterior edge. An indistinct bluish dorsal line. Horn reddish. Moulted 27-viii-42.

3rd instar—Similar, but colour rather yellower green and speckled minutely with yellow. An additional black dot on the 10th somite, and all ringed with whitish later in the instar. Horn short, dark pink. Fore part of the body slightly tapered. Moulted 29-viii-42.

4th instar—Variable, the usual form similar to the preceding instars, but with the black spots enclosed in an oval ring, bluish white above and yellowish below, the whole edged with a black line. Horn shorter comparatively. Legs pinkish. Another form has a suffused reddish-brown stripe above the subdorsal line from the ocellus on the 6th somite to the base of the horn. A third form has the whole dorsum between the subdorsal stripes suffused with rufous. A fourth form has the green colour, including the head, replaced by rufous. These last three forms with the prolegs deep

pink. A fifth form has the head and body dark chocolate brown, a narrow, double, paler stripe on the dorsum and a paler lateral stripe. Ocelli with the pupil black, the iris whitish, the whole enclosed in a black ring. Horn blackish brown. Legs, prolegs and venter brownish pink. Moulted 31-viii-42.

Final instar—Bred green form—Head green. Body yellow green. 4th somite with a small round subdorsal ocellus, consisting of a round black pupil surrounded by a greenish-white iris, the whole ringed by a black line. 5th to 9th somites with larger, similarly coloured, but oval, ocelli, the upper edge more convex than the lower. 10th somite with the ocellus reduced to the black pupil only. Legs pink. Prolegs deep pink. Spiracles purple with the ends whitish. Horn very short, straight, smoky at the sides, pinkish above, the extreme tip yellow.

Bred dark form—Head dull brownish olive, with a darker stripe each side of the clypeus, and speckled with paler. Body purplish brown, a dark chocolate brown median line, a dark chocolate brown, broad subdorsal stripe from head to base of horn and narrowing at both ends; the lateral area with a narrow whitish stripe above and below, tinged with chocolate brown on the thoracic somites and speckled throughout with whitish. Ocelli placed as in previous form and cut by the lower edge of the subdorsal stripe; the pupil black, the iris whitish and narrow above, deep yellow and slightly wider below, the whole encircled by a black line. Legs pink. Venter and prolegs very dark chocolate. Spiracles black with the ends yellowish. Horn with the upper surface orange, the sides dark chocolate, the extreme tip orange with a dark chocolate ring below. Pupated 5-ix-42.

There is a considerable amount of variation in the tint of the ground colour and in the degree of contrast between the dark and pale areas. In some examples the chocolate colour is tinged with olive, in others with reddish chestnut. Normally the dorsal and lateral areas are the same colour but the lateral area may be suffused with chocolate; in some examples the dorsal and lateral areas were cream-coloured. One specimen had the dark areas blackish purple, the light areas somewhat paler. The ocelli vary considerably in size. The contrast between the dark and pale areas is most marked early in the instar, later the contrast is reduced and the colours themselves degraded to a muddy or yellowish brown.

Wild green form—Wild green larvae are slightly different to the bred form. Head green. Body yellow green with minute yellow dots. Ocelli the same shape as in the other forms but the pupil blue-green, the iris of those on the 4th, 5th and 10th somites creamy yellow outlined by a black ring, of the remainder orange shading into yellow and outlined by a black ring. One had the ocelli on somites 6 to 8 only with the orange iris. Another had no orange round any of the ocelli and had the outlining black ring much broader above than below. Spiracles mauve with white ends. Legs pink. Venter and prolegs green. Horn green in some examples, pinkish in others, the extreme tip yellow.

Wild brown form—Head golden brown. Body pale golden

brown, a dark dorsal line on the thoracic somites. A slightly darker golden brown subdorsal stripe, faintly streaked with dark brown, from head to base of horn and narrowing at both ends. The ocelli with the pupil black, the iris purplish shading into whitish above, and pale orange shading into yellow below, the whole ringed by a black line. Legs pink. Prolegs and venter pinkish brown. Spiracles dark brown, the ends yellowish. Horn dark golden brown, the extreme tip orange. One bred example belonged to this form.

Pupa in captivity in a slight cocoon among litter. In the field a number were found spun up in growing leaves of the Arum on which they had been feeding. Colour pale yellowish bone colour, minutely streaked with dark brown, the abdominal somites with a dark olive dorsal line and a dark olive subdorsal stripe, traces of a dark spiracular stripe, a latero-ventral and median ventral stripe. Wing cases lined with dark brown. Tongue case forming a slight frontal keel. Spiracles protruding slightly. Cremaster short, black and pointed.

Food-plant—Arums of various species. Bell and Scott give *Jussiaea repens* L., *Boerhaavia* and *Aroideae* as food-plants.

Described from larvae bred from ova or found in their first and second instar in Calcutta.

Hampson describes the larva as 'green, with the dorsal area red-brown; a subdorsal paler line with equal sized ocelli from 4th to 10th somites with green centres; horn red brown.' Seitz writes 'Larva green or earth-coloured with lighter lateral stripes, on the 4th to 10th rings dark-centred eyes surrounded by dark; horn small. It chiefly lives on Taro (*Colocasia antiquorum*), also on *Jussiaea* (sic)'.

NOCTUIDAE.

Selepa celtis Moore.

Moore, *Lep. E. I. Co.*, 353, pl. 16, fig. 8a. 1858.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 370. 1894.

Hamps., *Cat. Lep. Phal.*, xi, 298. 1912.

Gaede, *Seitz Indo-Austr. Noctuidae*, xi, 396. 1937.

Gardner, *Indian Forest Records*, vi, 276. 1941.

Head black. Body greenish yellow, under a lens with indistinct longitudinal whitish lines. Some examples with traces of a black lateral line. A large black dorsal spot on 5th, 10th and 12th somites. Clothed with longish, single, white hairs, in some examples the hairs on the thoracic somites black. Legs and prolegs greenish yellow. The black dorsal spots do not appear until the penultimate instar. Gregarious.

Cocoon canoe-shaped of tawny silk, and covered with frass, etc. in captivity; in nature probably spun on a branch and covered with bark fragments. Pupa slender, golden yellow, the dorsal area on the abdomen tinged with orange, the lateral with green.

Food-plant—*Lagerstroemia indica* L. Gardner gives the following list, *Shorea robusta* Gaertn., *Eugenia jambolana* Lamb., *Careya arborea* Roxb., *Terminalia tomentosa* W. & A., etc.

Described from a number of larvae found in Calcutta, one of which spun 29-vii-42, and a male emerged 7-viii-42.

Hampson, in the Catalogue, gives the following reference and description:—‘Semper, *Reise. Phil., Schmett.*, ii, 529, pl. Q, figs. 12-14—Yellow; head black; dorsal black patches on 5th, 10th and 11th somites; a lateral reddish line with a series of black spots; hairs long and sparse; forms a cocoon covered with faeces.’ This description of Semper appears to be the basis of that in the Fauna and also in Seitz. Gardner correctly places the dorsal spots on the 2nd, 7th and 9th abdominal somites, but also mentions a smaller one on the 8th abdominal somite, this latter was absent in my specimens.

Attatha ino Drury

Hamps., *Cat. Lep. Phal.*, xiii 10. 1913.

Head slightly flattened, pale green very slightly tinged with brown. Body pale green, very similar in colour to the young leaves of Peepul on which it feeds, a broad white subdorsal line. The dorsal chord is plainly visible as a dark, pulsating streak. Legs pale green. Prolegs pale green slightly tinged with brown. Spiracles pale buff. The larva is somewhat flattened, particularly the thoracic and posterior somites. Before pupation the ground colour turns purplish pink and the lines fade.

Pupa subterranean in a slight cocoon of earth and silk. Colour dark purple brown, the thorax and wing cases darker, a darker dorsal stripe and the intersegmental areas. Cuticle punctate, the thorax and wing cases more so. Cremaster ending in a pair of divergent spines.

Food-plant—Peepul (*Ficus religiosa* L.).

Described from a full fed larva found in Calcutta 16-iv-42, buried 18-iv-42, and a male emerged 27-iv-42.

Hampson gives the following reference and description:—‘*Indian Museum Notes*, v, p. 114, pl. xiii, ff. 6a, b. Yellowish white or dark pink above, yellowish white below; lateral lines pale, more or less distinct; each somite with a few colourless bristles; head dirty white, pinkish, or brown. Food-plant, Pipal. Pupates underground without cocoon’.

Cosmophila sabulifera Guen.

Gardner, *Indian Forest Records*, vi, 288. 1941.

Head yellow green. Body olive green, a darker dorsal line due to the contents of the intestines, a white subdorsal line, a slightly sinuous white lateral line and a sinuous whitish sublateral line. Intersegmental rings yellowish. 1st somite with two dorsal, a subdorsal, and a lateral black dot on the anterior edge and a second series of two dorsal, a smaller subdorsal and lateral immediately behind. 2nd and 3rd somites with a black dot just above the subdorsal line, one between it and the lateral line, and three below. 4th to 11th somite with two dots above the subdorsal line, one between it and the lateral, and two below, the one above and anterior to the spiracles, the other below and posterior. 8th and 9th somites with

an additional spot at the base of the proleg. 12th somite similar but with no spots below the lateral line. The black dots all ringed indistinctly with whitish and with a single, short, black bristle. Venter, legs and prolegs rather more silvery green. The first pair of prolegs reduced. Spiracles brown ringed with whitish.

Pupa in a slight cocoon among leaves. Dull olive brown, a darker dorsal stripe on the abdominal somites, the intersegmental areas also darker. Minutely punctate. Cremaster ending in a bunch of golden brown hooked spines.

Food-plant—Gardner gives *Grewia tiliaefolia* Vahl, *G. asiatica* var. *vestita* Wall., *G. laevigata* Vahl and *Eriolaena Hookeriana* Wight and Arn.

Described from a full fed larva found in Calcutta 25-viii-42, pupated 28-viii-42, and a female emerged 3-ix-42.

Gardner gives the following description:—'Head dull yellow, body dull fairly dark green with two fine pale lines along each side. Setiferous rings on white spots themselves encircled by pink. Spiracles white with black rims. Prolegs on A₃ abruptly reduced. Labral emargination less than half deep. Length about 30 mm.'

Ericeia (Polydesma) inangulata Guen.

Head pale brown, reticulated with darker, a white spot on each side of the vertex; or in darker individuals blackish brown speckled with white and with two larger white spots on top of each lobe. Clypeus outlined with orange and with an orange line from apex to vertex. Body tawny brown, an orange dorsal stripe with a double central dotted line, a dark tawny subdorsal stripe sprinkled with minute dark dots and with a series of small white spots—two to each somite, a slightly paler tawny lateral stripe speckled with darker dots, which are more numerous in the middle, below this a darker tawny, dark speckled stripe, and below this again a paler tawny, dark speckled stripe. Venter pale tawny with a dark brown central stripe. Legs orange brown. Prolegs tawny, the feet pinkish, the first pair obsolescent. Spiracles blackish. Head and body with very short, very sparse, black hairs. Some examples are very much darker, the dark tawny stripes being almost black. When young very Geometer-like.

Pupa, in captivity, in a cocoon spun under a leaf and covered with earth. Rather slender, reddish brown, thorax and wing cases slightly darker, intersegmental areas darker. Pruinosed spiracles black. Apex of abdomen longitudinally wrinkled, the cremaster consisting of two longish, stout, hooked spines with a number of shorter and finer spines behind.

Food-plant—*Cassia fistula* L.

Described from a full fed larva found in Calcutta 29-vii-42, pupated 2-viii-42, and a male emerged 10-viii-42.

GEOMETRIDAE.

Scopula cleoraria Wlk.

Head pale brown with a whitish subdorsal and lateral stripe. Body brownish green, with an indistinct darker dorsal stripe, more

noticeable intersegmentally, and a whitish lateral line. 4th and 5th somites with an irregular, dark brown, sublateral spot, in some examples on the 6th and 7th somites also. The intersegmental divisions yellowish. Legs pale brown marked basally with darker. Shape very long and thin, slightly broader posteriorly. Rests extended straight out away from the support, or very slightly curved. The fore part is never coiled up. Turns crimson before pupation.

Pupa in a slight cocoon between leaves, in a state of nature probably among litter. Pupa pale chestnut tinged with green, the wing cases olive green. Spiracles black. Cremaster ending in two stout, longish, divergent, hooked spines, with four finer spines ventrally, last segment of abdomen with a transverse dentate dorsal ridge.

Food-plant—A cultivated Lantana, *L. sellowiana*.

Described from a full fed larva found in Calcutta 25-viii-42, pupated 31-viii-42 and a male emerged 7-ix-42.

PYRALIDAE.

Trachylepidia fructicassiella Rag.

Head chestnut. Body greyish with a chestnut dorsal plate on the 1st somite. Each somite with two pairs of minute black dots on the dorsum. A double lateral series of slightly larger black dots, one below and one above the spiracle. Anal somite marked with blackish. Legs chestnut. Venter and prolegs whitish. Spiracles chestnut ringed with black. A single colourless hair from each of the black spots.

Pupa in a shuttle-shaped cocoon of dense white silk. Venter and wing cases honey colour shading into a very pale chestnut dorsally on the thorax and abdomen. 1st to 8th abdominal somites with two chitinous, blackish, dorsal teeth, those on the 1st to 7th somite slightly apart, on the 8th almost joined.

The larvae live each in a separate compartment in the pod of *Cassia fistula*, but appear to congregate together to pupate, a compartment being completely filled with cocoons and frass.

Food-plant—*Cassia fistula* L., living in the pod and eating the ripe seeds.

Described from a full fed larva found in Calcutta 19-iv-42, pupated 24-iv-42, and a female emerged 29-iv-42.

Pachyzancla aegrotalis Zell.

Head brown. Body yellowish, appearing blue green from the contents of the intestines, a darker dorsal line. 1st and 2nd somites with a subdorsal black spot. A white spiracular line. A few colourless hairs arising from olive green spots, only visible under a lens. Legs colourless. Prolegs yellowish green. Lives in a spun together leaf.

Pupa in a spun together leaf, reddish chestnut, slender.

Described from a full fed larva found in Calcutta 30-vi-42, pupated 2-vii-42, and a male emerged 7-vii-42.

(To be continued)

FISH SURVEY OF HYDERABAD STATE.

Part II—Fishes of Hyderabad City and its suburbs.

BY

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Hyderabad City and its suburbs, popularly known as Balda and Atraf-i-balda district, are situated about in the centre of the State. It is surrounded by the districts of Medak and Karimnagar on the north, Mahboobnagar on the South, Nalgonda on the east, Gulbarga on the west and Bidar on the north-east. Its total area is 3,399 sq. miles, including the city of Hyderabad (26 sq. miles). The country is mostly hilly with a few wooded hills, known as the Rajkonda range, extending upto Nalgonda district. Another is the Anantgiri range extending from Mahboobnagar to Dharur near Vikarabad. A large portion of this range is composed of high level laterite; and isolated granite hills are seen everywhere amongst which Moula Ali, the Golconda rock and the Black rock of Trimulgherry are of special interest.

The most important river is the Musi, rising in the Anantgiri hills. It passes through the city and falls into the river Kistna near Wazirabad in the Nalgonda district. The river Manjra touches the district on the N.-W. side. Other smaller streams are the Sakalvani, Haldi, Deo, and the Eesi river.

The geological formation is Archaean Gneiss; tors and boulders of fantastic shapes are seen everywhere, composed of basalt and granite piled up in picturesque confusion.

Series of dams have been formed in the Musi and Eesi, and there are 143 large and about 300 small tanks; but most of the tanks hold water only for about 8 months in the year, some are in disrepair and if properly maintained may become sources of perennial supply. Here, I will deal only with some important perennial reservoirs.

The rainfall is only 30" and the temperature 62°-96° but it sometimes reaches even 108°. Population including Secunderabad is 16,53,249; number of fishermen 41,463.

Himayatsagar, with a water spread of 14.7 sq. miles is situated south-west of the city about 12 miles away. It is a dam of the Eesi river and two big 'nalias' also fall into it; its water is taken into the Meer-Alam tank by means of a channel and then supplied to the old part of the city. The margins are weedy, but the bottom is full of submerged boulders. The dam is 7,463 feet long with 17 automatic flood gates.

The methods of fishing are very primitive and practised in shallow water; fishing is done by means of long lines also, but owing to the presence of otters very few fishes are found intact in the morning when the line is taken out;

usually only the heads remain on the hooks. This reservoir contains much fish, and below is given the list of fishes obtained during the survey :

<i>Notopterus notopterus</i> (Pallas).	<i>Cirrhina reba</i> (Ham.)
<i>Notopterus</i> sp. nov.	<i>Labeo calbasu</i> (Ham.).
<i>Mastacembelus armatus</i> (Lacép.).	<i>Labeo fimbriata</i> (Bl.)
<i>Chela clupeoides</i> (Bloch).	<i>Glossogobius giuris</i> (Ham.).
<i>Rasbora daniconius</i> (Ham.).	<i>Ophicephalus marulius</i> Ham.
<i>Barbus</i> (<i>Puntius</i>) <i>kolus</i> (Sykes).	<i>Ophicephalus striatus</i> Bl.
<i>Barbus</i> (<i>Puntius</i>) <i>sarana</i> (Ham.).	<i>Heteropneustes fossilis</i> (Bloch).
<i>Barbus</i> (<i>Puntius</i>) <i>sophore</i> (Ham.).	<i>Wallagonia attu</i> (Bl.).
<i>Barbus</i> (<i>Puntius</i>) <i>ticto</i> (Ham.).	

Osmansagar (water spread area 16.22 sq. miles), about 11 miles west of the city, is the main source of water supply. The bottom is full of boulders; vegetation is scanty. It is formed by damming the Musi river which is a tributary of the Kistna. The dam is 6,3000 ft. long with 45 flood gates. The water level in this reservoir has gone down considerably during the last five years owing to scanty rainfall. The predominant fishes are the two varieties of carps, *Labeo calbasu* Ham. and *Labeo fimbriata* (Bl.). It is not open for netting; only angling is allowed.

List of fishes obtained :

<i>Notopterus notopterus</i> (Pallas).	<i>Labeo boggut</i> (Sykes).
<i>Notopterus</i> sp. nov.	<i>Labeo calbasu</i> Ham.
<i>Mastacembelus armatus</i> (Lacép.).	<i>Labeo fimbriata</i> (Bl.).
<i>Chela clupeoides</i> (Bl.).	<i>Labeo potail</i> (Sykes).
<i>Barilius barna</i> (Ham.)	<i>Glossogobius giuris</i> (Ham.).
<i>Barilius bendelisis</i> Ham.	<i>Ophicephalus marulius</i> Ham.
<i>Rasbora daniconius</i> (Ham.).	<i>Thynnichthys sandhol</i> (Sykes).
<i>Barbus</i> (<i>Puntius</i>) <i>sarana</i> (Ham.)	<i>Rohtee belangeri</i> Cuv. & Val.
<i>Barbus</i> (<i>Puntius</i>) <i>ticto</i> Ham.	<i>Callichrous bimaculatus</i> (Bloch).
<i>Cirrhina reba</i> (Ham.).	

Meer-Alam tank is about 4 miles south west of the city, and is a beautiful sheet of water; it is 8 miles in circumference. The dam consists of a series of 21 semi-circular retaining walls with their convex sides facing the water; its total length is 1,120 yards, and it was constructed by French engineers at a cost of 8 lakhs, during the time of Nawab Meer Alam; it is the main source of water supply to the old city. The margins are very weedy but the deeper parts are devoid of vegetation. It is noted for its rohu (*Labeo calbasu*) Ham. and 'phool-murrel', *Ophicephalus marulius* Ham. Only angling is allowed, but being near the city it is a great attraction for poachers.

Fishes obtained during survey :

<i>Notopterus notopterus</i> (Pallas).	<i>Glossogobius giuris</i> (Ham.).
<i>Notopterus</i> sp. nov.	<i>Rohtee cotto</i> var. <i>cunna</i> Day.
<i>Mastacembelus armatus</i> (Lacép.).	<i>Ophicephalus marulius</i> Ham.
<i>Rasbora daniconius</i> (Ham.).	<i>Ophicephalus punctatus</i> Bl.
<i>Barbus</i> (<i>Puntius</i>) <i>kolas</i> (Sykes).	<i>Ophicephalus striatus</i> Bl.
<i>Barbus</i> (<i>Puntius</i>) <i>sarana</i> (Ham.).	<i>Callichrous malabaricus</i> C.V.
<i>Barbus</i> (<i>Puntius</i>) <i>sophore</i> (Ham.).	<i>Heteropneustes fossilis</i> (Bloch).
<i>Barbus</i> (<i>Puntius</i>) <i>ticto</i> (Ham.).	<i>Clarias batrachus</i> Linn.
<i>Labeo calbasu</i> Ham.	<i>Wallagonia attu</i> (Bloch).

Hosainsagar is a large sheet of water which when full extends over an area of 8 sq. miles; it lies between Secunderabad and Hyderabad. It supplies unfiltered water to the Osmania University and to gardens of Hyderabad and Secunderabad. The dam is 2,500 yds. long and forms the road between the two cities. It was built by Sultan Ibrahim Kutb Shah about 1575 A.D. It is fed by 'Balkapur nala' running from the river Musi near Shankerpalli, and a small feeder channel known as 'Begampet nala' brings flood water from the adjacent hills during the rains. The stocking of the reservoir is not satisfactory, and if artificial means are not resorted to the finny population will gradually diminish and the rentals will fall within a few years. If the fisheries of this reservoir are developed on proper scientific lines they can be a great source of supply to the city markets.

It contains much vegetation, and its 'rohu' (*Labeo calbasu* Ham.) is of excellent taste. Other fishes are :

<i>Mastacembelus armatus</i> (Lacép.).	<i>Brachydanio rerio</i> (Ham.).
<i>Mastacembelus pancalus</i> (Ham.).	<i>Labeo calbasu</i> Ham.
<i>Chela clupeoides</i> (Bloch).	<i>Labeo fimbriata</i> (Bl.).
<i>Rasbora daniconius</i> (Ham.).	<i>Glossogobius giuris</i> (Ham.).
<i>Rasbora buchanani</i> Bl.	<i>Ophicephalus gachua</i> Ham.
<i>Barbus (Puntius) dorsalis</i> (Jerdon).	<i>Ophicephalus marulius</i> Ham.
<i>Barbus (Puntius) kohli</i> (Sykes).	<i>Ophicephalus punctatus</i> Bl.
<i>Barbus (Puntius) sarana</i> (Ham.).	<i>Ophicephalus striatus</i> Bl.
<i>Barbus (Puntius) sophore</i> Ham.	<i>Mystus vittatus</i> (Bloch).
<i>Barbus (Puntius) terio</i> (Ham.).	<i>Mystus cavasius</i> (Ham.)
<i>Barbus (Puntius) ticto</i> Ham.	<i>Wallagonia attu</i> (Bloch).

Danio aequipinnatus (McClelland). Young fry of *L. fimbriata* measuring 1"-2½" were obtained in the month of August from the upper reaches of 'Begumpet nala'.

Ibrahimpatan tank is about 20 miles from the city in the Baghat district, and has a water spread of about 6 miles when full. It was formerly fed by a channel from the river Musi but now this is in disrepair and hence the water level has gone down very low. It was noted for 'Murrel', but owing to the paucity of water it is being gradually overfished. At the time of the survey the water was very low and only about a sq. mile in area.

<i>Notopterus notopterus</i> (Pallas).	<i>Barbus (Puntius) ticto</i> Ham.
<i>Rasbora daniconius</i> Bl.	<i>Ophicephalus punctatus</i> Bl.
<i>Amblypharyngodon mola</i> (Ham.).	<i>Ophicephalus striatus</i> Bl.
<i>Barbus (Puntius) dorsalis</i> (Jerdon).	<i>Mystus vittatus</i> (Bloch).
<i>Barbus (Puntius) sophore</i> Ham.	

Notopterus sp. nov.

Notopterus sp., Rahimullah and Das.

Bull. Soc. Portug., Vol. XII, No. 18, pp. 135-141.

It is found in large numbers along with *Notopterus notopterus* (Pallas) but differs from it in many characters. Below I give the fin formula and other characters which identify it as a new species.

B=VII; D=8-10; P=14-15; V=5; A+C=101-117; Ll. % 180.

A distinct concavity on the head: (no concavity in *N. notopterus*); serrations exist along the lower surface of the preorbital, 28-31 serrations; the maxilla extends from $\frac{1}{2}$ to $\frac{2}{3}$ of the diameter of the orbit, and below the latter; the dorsal fin commences much nearer to the tail fin than to the snout.

The characters are intermediate between those of *N. notopterus* (*N. kopirat*) and *N. chitala* Day.

Labeo calbasu Ham.

Labeo calbasu (Ham. Buch.) Day, *Fauna Brit. Ind.*, Vol. I, pp. 259-260.

Day has described the colour as blackish; sometimes, especially in examples from clear streams, many of the scales have a scarlet centre.

The colouration was noted in fresh specimens from the same locality, and two varieties have been obtained; one is more or less black and the spots on the scales are not very distinct, but in the other variety the colour is silvery with scarlet spots on the scales, whilst in *L. fimbriata* there are orange patches on some scales.

Brachydanio rerio (Ham.)

Brachydanio rerio, Prashad and Mukherji, *Rec. Ind. Mus.*, Vol. xxxi, pt. iii, pp. 206-208.

Brachydanio rerio, Hora, *Ibid.*, Vol. xxxix, pt. I, pp. 8 and 15.

Brachydanio rerio, Bhimachar and Rau, *J. Mys. Un.*, Vol. I, pt. xvi, pp. 146 and 152.

The specimens were collected in large numbers from Hosain-sagar and its feeders. They agree in all characters with those described by Bhimachar and Rau. Lateral line and lateral line organs are absent. The fins are diaphanous. Upper half of the body is yellow and there are five steel-blue bands separated by yellow ones in the upper and by silvery bands in the lower half. Four horizontal bands on the anal, 3 distinct and two lighter ones on the caudal; pectoral and ventral fins yellowish. It has proved to be a very good larvicidal fish.

Thynnichthys sandkhol (Sykes).

Thynnichthys sandkhol, Day, *Fauna. Brit. Ind.*, Vol. I, p. 289.

Length of head $4\frac{1}{2}$, height of body $3\frac{3}{4}$ in the total length. Eye 4 in the length of the head, 2 diameters apart.

In colouration and other respects it is the same as described by Day.

Rohtee belangeri (Cuv. & Val.).

Rohtee belangeri, Day, *Fauna. Brit. Ind.*, Vol. I, p. 342.

It differs in its measurements from those given by Day.

Length of head 7, height of body $2\frac{3}{4}$ in the total length. Eye: head— $3\frac{1}{2}$, $1\frac{1}{4}$ diameters from end of snout $2\frac{3}{4}$ diameters apart.

This fish is commonly found in all parts of the dominions.

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THE MEDICINAL AND POISONOUS LINDENBLOOMS OF INDIA.

BY

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The TILIACEÆ are trees or shrubs, rarely herbs. Most of them are tropical; a few inhabit the temperate northern hemisphere, and some are found behind the tropic of Capricorn; but none extend into the Arctic Circle, or ascend to great mountain elevations. The 380 species are distributed into 35 genera.

In general the leaves are mucilaginous and emollient; the bracts and flowers are aromatic, antispasmodic, and slightly sudorific. The bark may be bitter and astringent.

Among the products obtained may be mentioned:— (1) a volatile oil; (2) *laevo-rotatory phytosterols*; (3) *vanillin*; and (4) *glucosides*—*capsularin*, *corchorin*, *tiliacin*—.

The medicinal and poisonous Lindenblooms of the world belong to 12 genera: *ANCISTROCARPUS* (tropical West Africa); *CISTANTHERA* (tropical Central and West Africa); *CORCHOROPSIS* (Japan, China); *CORCHORUS* (warm regions); *ELÆOCARPUS* (tropical); *GLYPHEÆA* (tropical Africa); *GREWIA* (Asia, Africa, Australia; mostly tropical); *LUEHEA* (tropical America, West Indies); *SLOANEA* (tropical); *SPARMANNIA* (tropical and South Africa); *TILIA* (northern temperate regions); *TRIUMFETTA* (tropical).

The medicinal and poisonous Lindenblooms of India belong to 4 genera: *CORCHORUS*, *ELÆOCARPUS*, *GREWIA*, *TRIUMFETTA*.

A. Anthers opening by slits.

I. Petals usually foveolate or glandular at the base; stamens springing from the apex of a raised torus.

- Fruit without prickles GREWIA.
- Fruit prickly.
Herbs or undershrubs. Fruit small ... TRIUMFETTA.

II. Petals not foveolate or glandular at the base; stamens springing from a contracted torus ... CORCHORUS.

Anthers opening by a terminal pore.
Petals sepaloid ELAEOCARPUS

CORCHORUS.

The genus consists of 40 species widely dispersed throughout the warm countries of the world.

The following are used medicinally in the Philippine Islands—
C. acutangulus Lam., *C. capsularis* Linn.—; in Indo-China—*C. capsularis* Linn.—; in Egypt—*C. olitorius* Linn.—; in Gold Coast—*C. acutangulus* Lam.—; in Southern Africa—*C. asplenifolius* Burch., *C. serratifolius* Burch.—.

A Capsule globose, not beaked ... *C. capsularis.*
 B. Capsule elongated.
 1. Beak 3-fid spreading ... *C. acutangulus.*

II. Beak entire.

1. Capsule glabrous, cylindric, 10-ribbed.
Beak long, erect *C. olitorius*.
2. Capsule scabrous or aculeate, 3-angled.
Beak short, erect *C. trilocularis*.

C. Capsule short, beak entire.

- I. Annual. Capsule pubescent, 3-valved ... *C. fascicularis*.
- II. Perennial. Capsule glabrous, 4-valved ... *C. depressus*.

1. **Corchorus acutangulus** Lam. is found throughout the hotter parts of India and Ceylon. It is distributed to Australia, tropical Africa, and the West Indies.

The bitter seeds are given by the Mundas of Chota Nagpur in pneumonia and stomach ache.

In Gold Coast the whole plant, including the root, is used in the form of an injection for urethral discharges.

Akim : Survabiri—; *Awuna* : Lolui-tsu—; *Bengali* : Titapat—; *Ewe* : Have—; *Ibo* : Aheheara, Ahihira—; *Krepi* : Ademadema, Adomadoma ; *Krobo* : Togatoya—; *Mende* : Ndogbo-ngengele—; *Mundari* : Karigiri, Karijiri, Karijuri, Pirititudiring—; *Tubu* : Koebulu—; *Twi* : Padeedec, Siwabiri—; *Yoruba* : Abojaga, Abo jaja—.

2. **Corchorus capsularis** Linn. occurs throughout the hotter parts of India. It is cultivated in most tropical countries.

A decoction of the dried root and unripe fruit is given in diarrhoea.

In cases of dysentery the dried leaves are eaten at breakfast time with rice. The cold infusion is also administered as a tonic in dysenteric complaints, fever, and dyspepsia.

It is a common practice in the jute-growing districts of Bengal to keep a small stock of the dried jute leaves in the house, whereof an infusion—a so-called tea—is made and taken by those suffering from any disorder of the liver. From the reports received by the Indigenous Drugs Committee it appears that the infusion is used as a popular domestic medicine for disorder of the liver and is of great value when there is a trouble with burning sensation in hands and feet. It is also used as a bitter tonic, stomachic, laxative, carminative, stimulant to increase appetite and flow of saliva and gastric juice; also as an antiperiodic, anthelmintic, astringent and intestinal antiseptic. It has been reported as efficacious in fever, bilious troubles, worms of children, dysentery, hepatic and intestinal colic, gastralgia and gastric catarrh, skin diseases especially itches, atonic dyspepsia, slight jaundice, and in the disorder of the digestive system.

In Indo-China the flowers are given in epistaxis; the fruits are applied to swelling and abscesses, and prescribed in diseases of the bladder.

Assam : Marasag, Titamara—; *Bengal* : Ghinalitapat, Koshta, Narcha Titthapat—; *Bombay* : Chouchen, Ghinalitapat, Narcha—; *English* : Jute—; *Formosa* : Ma-p'i—; *French* : Chanvre de Calcutta, Jute—; *Hindi* : Ghinalita, Koshta, Narcha, Pat—; *Indo-China* : Bo day, Floang ma, Ta ma—; *Marathi* : Chaunchan—; *Mundari* : Hatularia—; *Philippines* : Patas, Ponglopongloan—; *Porebunder* : Borachhunchh, Chhunchh—; *Portuguese* : Juta—; *Sadani* : Larita—; *Sanskrit* : Kalasaka, Nadikapatta—; *Santali* : Kaskomrau—;

Shahjahanpur : Harrawa—; *Sinhalese* : Jaladara—; *Tagalog* : Pasaonabilog—; *Tamil* : Pirattikirai—; *Visayan* : Lamhay—.

3. ***Corchorus depressus*** Stocks is found in the Punjab, Sind, Baluchistan, Cutch, Gujarat, Deccan. It is distributed to Afghanistan, Arabia, North Africa, Cape Verde Islands, and tropical Africa.

The plant has tonic properties. It is given as a cooling medicine in fever.

The mucilage is used in Sind for gonorrhoea.

The leaves are emollient. The Baluchis make a cooling drink out of them. In Jaisalmer and Jodhpur they are applied to wounds, and a decoction is said to be efficacious in cases of skin eruption.

The seeds in decoction, with milk and sugar, are given as a tonic.

Arabic : Ueki—; *Baluchistan* : Mandira, Munderi, Mundheri—; *English* : Shrybby Jute—; *Gujerati* : Bahuphal, Bethibahuphal, Chhikni, Chhunchh—; *Hindi* : Baphuli—; *Marathi* : Bahuphal—; *Punjab* : Babuna, Bahuphalli, Bophalli, Kurana—; *Rajputana* : Hadekakhet—; *Sanskrit* : Bhedani, Chanchu, Katuka, Kshudra, Ksudrachanchu, Patupatrika, Shunakuchanchuka, Tvakasara—; *Sind* : Mudhiri, Munderi—; *Urja* : Bojoromuli—.

4. ***Corchorus fascicularis*** Lam. occurs throughout the hotter parts of India. It is distributed to tropical Africa and Australia.

It is very mucilaginous and somewhat astringent, and is valued as a restorative.

In Bombay, a watery extract, mixed with sugar-candy, is taken as a nutritive tonic.

Bengal : Banpat, Bilnalita, Janglipat—; *Bombay* : Bhauphal, Hirankhori, Mothibahuphal—; *Gujerat* : Chhunchhadi, Ubhibahuphal—; *Hindi* : Bankssto, Janylipat, Khetapat—; *Marathi* : Hirankuri, Motibahuphal—; *Poona* : Mayarmithi—; *Porebunder* : Chhunchhadi, Ubhibahuphal—; *Sanskrit* : Bhirupatrika, Chanchu, Chanchuputra, Chanchura, Chhunchhu, Chincha, Diagh-patri, Kalabhi, Kshestrachhunchhu, Kshestrasambhava, Sushaka, Vijala—.

5. ***Corchorus olitorius*** Linn. is generally distributed by cultivation in all tropical countries. The chief seat of its Indian cultivation is near Kulna in the Burdwan district of Bengal.

The dried plant, roasted and powdered, is used in visceral obstruction. In South India it is used as a demulcent.

The leaves are demulcent, tonic and diuretic, useful in some cases of chronic cystitis, gonorrhoea and dysuria.

The leaves and tender shoots are eaten, and in the dried state, known as *nalita*; they are used in infusion by the natives as a domestic medicine, being tonic and slightly febrifuge, and hence used as a fever drink.

The dried leaves are sold in the market. A cold infusion is used as a bitter tonic, and is devoid of any stimulating property. It can be safely given to patients recovering from acute dysentery to restore the appetite, and improve the strength.

The seeds are purgative. In Egypt they are put into the eye to cause inflammation by way of malingering.

Abeokuta : Eyo—; *Arabic* : Melochia, Meloukhia, Meluhhije, Molochia, Molukhyia, Muluhhije—; *Awuna* : Ademe—; *Bengal* : Banpat, Bhungipat, Phunjipat, Koshta, Lalitapat, Pat—; *Berar* : Chooich—; *Bombay* : Chhunchh, Motichhunchh, Tankla—; *Efik* : Etinyon—; *Egypt* : Melukhiye—; *Eko* : Etinyung—; *English* : Jew's Mallow, Jute, Long-fruited Jute—; *Ewe* : Sigli,

Singili, Singli—; *Fanti*: Otoro, Oturo—; *French*: Corète, Corette potagère, Guimauve potagère, Mélochier—; *Fulani*: Lolo, Lolo memel—; *Ga* Otoro, Oturo—; *Gambia*: Alo—; *German*: Gemuese Corchorus—; *Greek* Corchoros—; *Gujerati*: Chhunchho—; *Hausa*: Lalo, Malafiya, Marafiya Tungurnuwa—; *Hindi*: Banpat, Koshta, Pata, Sanpat, Singinjanasha—; *Ho* Hatempa—; *Ibo Owerri*: Ahu hara—; *Ijebu-Ode*: Ayo—; *Ilesha*: Yoyo—; *Iraq*: Malukhiyah—; *Kanuri*: Darraba, Gamgaine—; *Katsina*: Turgun nuwa—; *Kissi*: Yo-ngengey—; *Konno*: Kokoe—; *Kratchi*: Aposse—; *Lagos* Ewedu—; *Mandingo*: Kiringere—; *Marathi*: Chunch, Motichunch—; *Mende* Gingere, Ngenge, Ngenge, Yengei, Yeingei—; *Mundari*: Larita—; *Nimar* Rajan—; *North-Western Provinces*: Banphal—; *Oloke Meji*: Eyo-ganbi—; *Porebunder*: Chhunchho, Chunchhdo, Motichhunchh—; *Punjab*: Banpat, Banphal—; *Sadani*: Larita—; *Sanskrit*: Brihatchanchu, Dirghapatri, Divyagandha Kalasa, Mahachanchu, Nadika, Patta, Singgika, Sthulachanchu, Suchanchuka Vishari—; *Santali*: Birnarcha—; *Senoufo*: Sobo—; *Serere*: a Koud—; *Sherbro*: Krinkrin-de—; *Sierra Leone*: Bush Okra, Crincra, Crincer, Ingle—; *Sind*: Banpat—; *Sinhalese*: Wanuk—; *Sobo*: Oyoyo—; *Susu*: Suri—; *Tamil* Peratti, Perumpunnakhippoondu, Punaku—; *Telugu*: Parinta, Parintakura—; *Timne*: Kenkerin, Kirirkirin—; *Umu Ahia*: Agheregha, Aheheara, Ahihira—; *Uriya*: Jhoto, Joto, Kaunria—; *Wolf*: Mbali—; *Yemen*: Melochia—, *Yoruba* Ewedu-ga-nbe, Eyo, Eyo-ga-nbe, Oyo—.

6. *Corchorus trilocularis* Linn. is found in Bihar, the Deccar and Carnatic of the Madras and Bombay Presidencies, Khandesh, Gujarat, Cutch, Sind, Baluchistan; whence it extends to Afghanistan, Arabia, tropical and southern Africa.

The plant, macerated for a few hours in water, yields a mucilage, prescribed as a demulcent.

The seeds are bitter and administered in doses of about 80 grains in fever and obstruction of the abdominal viscera.

Arabic: Melochia, Molukhiya—; *Arago*: Emakikoho—; *Bombay* Kaduchhunchh, Kuruchuntz—; *Canarese*: Tanolassir—; *Egypt*: Melukhiye—; *Fulani*: Lalo—; *Gujerati*: Kadvi-chhunchhdi—; *Hausa*: Lalo, Turgunuwa—; *Hindi*: Kadukosta, Kadvapat—; *Malay*: Ramput baya roaza—; *Marathi* Kaduchhunch—; *Nasirabad*: Datrab—; *Porebunder*: Lambichhunchh—; *Rajputana*: Hardikeket, Kaglekitamaku, Karak—; *Sanskrit*: Dirghachanchu Kaanti, Nadika—; *Sinhalese*: Jawedara, Wanuk—; *Songhai*: al Mulugia—; *Tamil*: Peratti, Punnakkippoondu, Talakkaipoondu—.

ELAEOCARPUS

The genus numbers 90 tropical species, most abundant in the hotter parts of India and the Indian Archipelago; a few are found in some of the South Sea Islands, New Zealand, and Australia.

E. madepolatus Pierre is used medicinally in Cambodia, *E. photiniaeefolia* Hook. and Arn. in Indo-China.

A. Anthers not terminated by an awn.

I. Drupe 5-celled *E. Ganitrus*

II. Drupe 1-3-celled.

a. Anthers bearded. Filaments short, straight *E. serratus*.

b. Anthers rarely bearded. Filaments long, twice bent *E. oblongus*.

B. Anthers terminated by a long awn.

Leaves obovate. Stone much tubercled ... *E. tuberculatus*.

I. *Elaeocarpus Ganitrus* Roxb. is found in the Western Ghats and the Konkan of the Bombay Presidency, Nepal, Bengal, Burma, Siam, the Malay Peninsula and Archipelago.

The fruit is used by Hindu practitioners in diseases of the head and epileptic fits.

Bengal : Rudrakya—; *Canarese* : Rudraksha—; *English* : Utrasm Bead Tree—; *Hindi* : Rudrak—; *Malayalam* : Rudraksham—; *Marathi* : Rudraksh—; *Sanskrit* : Amara, Bhutanashana, Harksha, Nilakanthaksha, Pavana, Pushparchanamara, Rudraksha, Sharvaksha, Shivaksha, Shivapriya, Trinameru—; *Tamil* : Akkam, Irattaiyuruttirasham, Kaurichangamani, Uruttiradcham, Uruttirakkam—; *Telugu* : Rudrachallu—; *Tulu* : Rudraksha—; *Uriya* : Rudrakhyo—.

2. ***Elaeocarpus oblongus*** Gaertn. occurs in the Western Peninsula, and in Malaya.

The fruit is used as an emetic.

Badaga : Bikki—; *Canarese* : Bikki, Hanaltadi, Hanillatade, Hennalatade—; *Malayalam* : Kattakara, Malankara—; *Tamil* : Kattukkarai—; *Visayan* : Cabalte, Cabilte—.

3. ***Elaeocarpus serratus*** Linn. is found in the Western Peninsula, Ceylon, and Malaya.

The leaves are used in rheumatism, and as an antidote to poison.

The fruits are prescribed in dysentery and diarrhoea.

Bengal : Jalpai—; *Canarese* : Bigada, Guddarenje, Perinkara—; *English* : Wild Olive—; *Hindi* : Jalpi—; *Malayalam* : Avil, Karamavu, Nallakara, Perunkara, Valiyakara—; *Sanskrit* : Chiribilva—; *Sinhalese* : Weralu—; *Tamil* : Ulangarai, Uruttiracham—; *Tulu* : Rahubija—; *Uriya* : Jolopari—.

4. ***Elaeocarpus tuberculatus*** Roxb. is found in the Western Peninsula, and in Malaya.

A decoction of the bark is given in vomiting of blood, and in biliousness.

The nuts are used in rheumatism, typhoid fever, and epilepsy.

Badaga : Rudraksha—; *Canarese* : Bhutali, Dandele, Dandla, Rudrak, Rudraksha, Rudrakshi—; *Hindi* : Rudrak—; *Kadir* : Navati, Pagumbal, Pillahi, Pulandi—; *Malayalam* : Ammakkaram, Kotuvasi, Maggara, Nakara, Navati, Pillahi, Pulanthi—; *Mysore* : Danala—; *Tamil* : Pagumbal, Rudraksham, Uruttracham—.

GREWIA

The genus numbers 150 species spread over Asia, Africa and Australia, mostly tropical.

Mucilaginous and demulcent, useful in the treatment of diarrhoea and dysentery.

The following are used medicinally in Indo China—*G. paniculata* Roxb.—; in the Philippine Islands—*G. paniculata* Roxb., *G. umbellata* Roxb.—; in Australia—*G. hirsuta* Vahl—; in Tropical Africa—*G. carpinifolia* Juss., *G. mollis* Juss., *G. populifolia* Vahl, *G. villosa* Willd.—; in South Africa—*G. occidentalis* Linn.—.

- A. Inflorescence terminal and axillary (sometimes extra-axillary). Flowers in umbellate cymes
 - I. Scandent shrubs. Torus long. Drupes obscurely lobed, purple *G. umbellata*.
 - II. Shrubby. Torus short. Drupes yellowish, generally 2-lobed, lobes the size of a small pea, orange-red *G. populifolia*.

- B. Inflorescence leaf-opposed and axillary. Leaves glabrous or nearly so *G. tenax.*
- C. Inflorescence axillary (rarely extra-axillary).
 - I. Leaves usually hoary, at least beneath.
 - Leaves 5-6-nerved
 - 1. Stipules leafy, auricled *G. tiliaeefolia.*
 - 2. Stipules linear-lanceolate *G. assatica.*
 - II. Leaves not hoary beneath, orbicular.
 - Anthers glabrous
 - a. Drupes with a crustaceous rind
 - 1. Leaves 3-6 by 4 in. *G. sclerophylla.*
 - 2. Leaves 3 by $\frac{1}{2}$ in.; petiole $\frac{1}{4}$ in. *G. carpinifolia.*
 - 3. Leaves 1-3 in.; petiole $\frac{1}{2}$ -1 in. *G. villosa.*
 - b. Drupes fleshy. Flowers polygamous.
 - Branched shrub. Stamens more than 40 ... *G. hirsuta.*
- D. Inflorescence terminal, in panicled cymes
 - Flowers involucrate.
 - I. Petals oblong, entire or shortly emarginate.
 - Three shorter than sepals *G. Microcos.*
 - II. Petals entire, much shorter than sepals *G. paniculata.*

1. *Grewia asiatica* Linn. is cultivated throughout India.

The fruit is a well-known Ayurveda medicine credited with astringent, cooling, and stomachic properties.

An infusion of the bark is used as a demulcent. The Santals use the root-bark for rheumatism.

The leaf is employed as an application to pustular eruptions, and the bud is also prescribed by native practitioners.

Ajmere : Dhamni—; *Arabic* . Phalasar—; *Bengal* : Phalsa, Shukri—; *Burma* : Pintyaw, Tagaw—; *Bombay* . Phalasi—; *Canarese* : Buttiyudippe, Jana, Tadasala—; *Central Provinces* : Dhamru, Dhamun—; *Deccan* : Phulsha, Pulsha—; *Gujerat* . Phalsa—; *Hindi* : Dhamin, Karra, Parusha, Phalsa, Pharvah, Pharsa, Phulsa, Shukri—; *Kohlu* . Pistawan—; *Kolam* : Gonyia, Sing-hundamini—; *Konkan* . Phalsi—; *Ketra* : Pharwan—; *Malayalam* : Chadicha—; *Marathi* : Phalsi—; *Nepal* : Sialposra—; *Newari* : Fussi—; *North-Western Provinces* . Dhaman, Phalsa, Pharsiya—; *Parbut* : Falsa, Fursu—; *Persian* : Falseh, Palasah—; *Punjab* : Phalsa, Phalso, Pharoah, Phalue—; *Pushtr* . Pastaomi, Shikarimaiwah—; *Sanskrit* . Alpasthi, Dhanvanchhada, Girilipu, Mriduphala, Nagadalapam, Nilacharma, Nilamandala, Parapara, Paravata, Parusha, Parushaka, Porusha, Purusha, Roshana—; *Santal* : Jangolat—; *Sind* : Phalsa, Phalso, Pharaho, Pharoah—; *Sinhalese* : Dowaniya, Hin-damaniya—; *Tamil* : Palisa, Tadachi, Unnu—; *Telugu* : Jana, Nallajana, Peddajana, Phutiki, Putiki—; *Urdu* : Phalasar—; *Uriya* : Iharosakoli—.

2. *Grewia carpinifolia* Juss. is found in the Western Peninsula and is distributed to Tropical Africa.

In West Tropical Africa the plant is used medicinally or to combine with other medicines. Women use it in washing the hair to remove or prevent lice, and put the roots in soup when approaching childbirth.

In East Tropical Africa the broth obtained by boiling the head of a kid in a decoction of the root is taken in cases of diuresis and polyuria.

Ashanti : Ntabanu—; *Ewe* : Gayalige, Tupoetupoe—; *Fanti* : Nkukumbe, Ntaanta—; *Ga* : Asegeteete-ntaata, Asegremi-tsho—; *Gosha* : Donoi—; *Krobo* : Akpe-tsho—; *Somali* : Debi—; *Yoruba* : Itakun okere—.

3. **Grewia hirsuta** Vahl occurs in the sub-Himalayan tract up to 4,500 feet from the Indus eastwards, the Salt Range, Bihar, Orissa, Burma, the southern Provinces, and Ceylon. It is distributed to North Australia.

The fruit is employed as a medicine by the Santals, in diarrhoea and dysentery. The root pounded is also prescribed for the same diseases, and powdered in water is applied externally to hasten suppuration, and as a dressing for wounds. The paste dries and forms a hard coating, thus effectually excluding air from the raw surface.

This plant is used by the aborigines of North-Western Australia as a remedy for dysentery.

Arabic : Kamaetus—; *Australia* . Plain Currant—, *Betul* . Kharota—; *Bombay* : Gowali, Gowli—; *Burma* : Kyettayaw—; *Canarese* : Chikkudipe, Jana, Udipe—, *Hasada* : Setale—, *Hindi* : Gursukri, Kakarundah, Kukurbucha—; *Kharwai* : Gursukri—; *Kolami* : Setaandir, Setabeli, Setakata—; *Marathi* : Govli—, *Aerwara* . Phrongli—, *Naguri* : Seta-bili, Seta-kata—; *Persian* : Karatasrumi—; *Porebunder* . Khoddhramani—; *Queensland* : Karoom, Kooline, Ouraie—; *Santal* : Setaandir, Setabeli, Setakata—; *Tamil* : Tavidu—; *Telugu* : Bidarachipuru, Budda, Chinnachipuru, Chipuru, Chittijana, Jibilike, Muvalchu, Tellajana—, *Urdu* : Kakarundehrumi—; *Uriya* : Kulo, Sonaranga—

4. **Grewia Microcos** Linn. occurs in Eastern Bengal, Assam, Burma, the Western Peninsula, Mysore, and Ceylon. It is distributed to Java and China.

The plant is much used medicinally; it is given for indigestion, eczema and itch, smallpox, typhoid fever, dysentery, syphilitic ulceration of the mouth.

Bombay Ansale, Shiral—; *Burma* . Myaza—, *Canarese* : Abhhrangu, Bilyabhrangu, Majjigesoppu—, *Malayalam* . Kottakka—; *Sinhalese* : Kehiya—, *Tamil* : Kadambu, Visalam—; *Tulu* . Abroni—.

5. **Grewia paniculata** Roxb. is common in the Malay Peninsula and in Indo-China, in open country.

In the southern parts of Indo-China a decoction of the roots is given as a cure for cough.

Indo-China : Co ke, Poplear thom—, *Malay* : Chenderai hutan—; *Visayan* Bangalad—.

6. **Grewia populifolia** Vahl extends from the arid tracts of the Punjab, Sind, Rajputana, and Western India, down to the Nilgiri Hills. It is distributed to Afghanistan, Arabia, tropical Africa, Mauritius.

A mucilage of the bark is used by the women of West Tropical Africa to cleanse the hair of vermin.

Somali women take a decoction of the roots to incite the foetus in the womb and thus ascertain that it is alive.

Falor : Sonne—; *Gosha* : Moris—; *Kohat* : Shikari mewa—; *Kolami* : Bursa—; *None* : Sonne—; *Punjab* : Ganger, Gangi, Kanger, Khircha, Inzarre—; *Pushtu* : Khircha, Madzar—; *Rajputana* : Ganegam, Gangan, Gangerun—; *Serere* : Nghel, Nguel—; *Sind* : Gangi, Gango—; *Somali* : Morio—; *Telugu* : Gundukadira, Kadadari, Kaladi, Kattekolupu—; *Tuareg* : Tarkat—; *Tukulor* : Keli, Kelli—; *Wolof* : Kel—.

7. **Grewia sclerophylla** Roxb. occurs throughout the sub-Himalayan tract and outer hills of Kumaon, up to 3,500 feet, Sikkim, Assam, Chittagong, Ava.

The root is prescribed in coughs and irritable conditions of the intestines and bladder. The decoction is also used as an emollient enema.

Bengal : Phalsu—; *Burma* : Petshat—; *Canarese* : Darsuk, Kadukadele—; *Cutch* : Susaka—; *Dehra Dun* : Gurbheli—; *Gujerati* : Padekado—; *Haldwani* : Phalsu—; *Hindi* : Pharsia—; *Kumaon* : Pharsia—; *Marathi* : Khatkhati, Pandharidhaman—; *Mundari* : Gaphni—; *Tamil* : Kattukkadali, Punaippidukan—; *Telugu* : Bankajana—; *Tharu* : Dapher—.

8. **Grewia tenax** Fiori is found in the Punjab, the desert of Western Rajputana, Sind, Baluchistan, Cutch, Southern Maratha Country, the Deccan and Carnatic of the Madras Presidency, and Ceylon. It is distributed to Afghanistan, Persia, Arabia, tropical Africa, and Mauritius. It is most probably identical with *G. populifolia* Vahl.

A Baluchi medicine for all sorts of diseases and very highly esteemed. The berries are given for colds.

In Jhalawan a decoction of the wood is given as a cure for coughs and pains in the side.

Arabic : Chodar, Moucken, Nabba—; *Baluchi* : Gwangir, Buzi putrunk—; *Brahui* : Gwangir—; *Jhalawan* : Gwangi, Kango—; *Kalat* : Rango—; *Mandi* : Putrunk—; *Rajputana* : Gangeran, Gangerun, Gangi, Gango, Kankeran—; *Sinhalese* : Katupratti—; *Tamil* : Achu—; *Telugu* : Gundukadira, Kadadari, Kaladi, Kattekolupu—.

9. **Grewia tiliaceifolia** Vahl occurs in the sub-Himalayan region from the Jumna to Nepal up to 4,000 feet, Central India, all the districts of the Madras Presidency, Bihar, Orissa, Burma, and Ceylon. It is distributed to East Tropical Africa.

In the Konkan the bark, after removal of the tuber, is rubbed down with water, and the thick mucilage strained from it and given in 5-tola doses, with 2 tolas of the flour of *Panicum miliaceum* (warri) as a remedy for dysentery.

The bark is also employed externally to remove the irritation from cow-itch.

The wood reduced to a powder acts as an emetic, and is employed as an antidote to opium poisoning.

Bengal : Dhamani, Pharsa—; *Bhil* : Dhamnak—; *Bombay* : Damana, Karakan—; *Canarese* : Battale, Butale, Buttele, Dadsal, Jana, Tadagana, Tadasali, Tadasalu, Thadasal, Thadsal—; *Central Provinces* : Daimun, Dhaman, Dhamni—; *Ceylon* : Chadachi—; *English* : Dhaman—; *Gond* : Ainlubaranda, Kasul, Khesla—; *Gujerat* : Dalmon, Dhamana—; *Hindi* : Dhaman, Dhamani, Dhamin, Pharsa—; *Kashmir* : Chatachi, Una—; *Kharwar* : Dhaman—; *Khond* : Kahal, Karkana—; *Kolam* : Ahsing, Dhamin, Gonyer—; *Konkan* : Butale, Dadsale, Damoni—; *Kumaon* : Pharsia—; *Kurku* : Dhamni—; *Malayalam* : Satchi, Una—; *Marathi* : Daman, Danni, Dhaman, Karavam, Karakarani—; *Matheran* : Dhaman—; *Mundari* : Asin, Asindaru, Bengadaru—; *Mayurbhanj* : Kultho—; *Porebunder* : Dhaman, Dharman—; *Sanskrit* : Dhamsi, Dianuvriksha, Dharmana, Dharwana, Manabala, Pichhilaka, Pichhilatvaka, Raktakusuma, Rujasaha, Ruksha, Swaduphala—; *Santali* : Janoolat, Olat—; *Suora* : Inuputada—; *Sinhalese* : Daminiya, Daminne—; *Tamil* : Sadachi, Tada, Tarra, Una, Unnu—; *Telugu* : Charachi, Ettatada, Jana, Nulijana, Tada, Tadajana, Udupai—; *Tulu* : Kanapadi—; *Uriya* : Bhangia, Dhaman, Dhamono, Dhamuro—.

10. **Grewia umbellata** Roxb. is found in the Malay Peninsula, Siam, and Borneo.

The leaves are applied to cuts and wounds.

Malay: Akar chenderai, Akar kapialu, Akar sekapu, Akar sempelas lida kuching—; *Philippines*: Danloy—.

11. **Grewia villosa** Willd. occurs in the Trans-Indus, the Punjab, Rajputana, Sind, Cutch, Kathiawar, the Deccan and Carnatic of the Madras Presidency from the Kistna southwards. It is distributed to the Cape Verde Islands and tropical Africa.

The juice of the fresh bark is used with sugar and water for gonorrhœa and urinary complaints attended with irritability of the bladder.

The root is employed for diarrhoea in Chota Nagpur.

East of Chad, in tropical Africa, the root is an ingredient in native prescriptions for syphilis and smallpox.

The roots macerated and triturated with milk are a Somali cure for belly ache in babies; the adults apply a poultice to the abdomen, the roots are ground with as little water as possible.

Ajmere: Dhohan—; *Baluchi*: Pachini putrunk—; *Canarese*: Buttigaragale, Garakele, Sannudippe—; *Cutch*, Luskano—; *Ewe*: Adzadze—; *Falor*: Lekit—; *Gujerati*: Padekhado, Parekhado—; *Hausa*: Gwiwar rak 'umi—; *Kamba*: Mugu—; *Kolam*: Gaphni—; *Mangu*: Yumbu—; *Marathi*: Kharmati—; *Merwara*: Dhokelan—; *None*: Ngomen—; *Punjab*: Jalidar, Kaskusri, Thamther—; *Pushtu*: Inzarra, Pastuwanne—; *Rajputana*: Lonkas—; *Santah*: Tarsekolap—; *Tamil*: Kullai—; *Telugu*: Benta, Chenula—; *Tigre*: Hafule, Khafule—; *Wolof*: Horom sap—.

TRIUMFETTA

The genus consists of 75 tropical species.

All the species are mucilaginous, demulcent, bechic, and diuretic; but those more commonly used are *T. rhomboidea* Jacq. and *T. semitriloba* Linn. generally, and *T. Lappula* Linn. in Guyana.

Fruit the size of a small pea; spines hooked, glabrous or ciliated *T. rhomboidea*.

Fruit the size of a large pea; spines bristly or shaggy ... *T. semitriloba*.

1. **Triumfetta rhomboidea** Jacq. occurs in tropical and sub-tropical India, Ceylon, the Malay Peninsula and Archipelago, from which it extends to China. It is distributed to Africa and America.

The root is bitter and acrid, and used as a diuretic.

The bark and fresh leaves are given in diarrhoea and dysentery.

The leaves, flowers and fruits are mucilaginous and astringent. They are given in gonorrhœa. The fruit is believed to promote parturition.

Zulu women take a hot infusion of the root to facilitate child-birth or to hasten the inception of parturition when it is delayed.

In La Reunion and Mauritius the mucilaginous roots and flowers are used for their demulcent, bechic, and diuretic properties.

The pounded root is applied to sore eyes and to boils in Madagascar; the leaves and the stems bruised together are used for poulticing all sorts of tumours. In the district of Menabe the plant, associated with *Cynodon dactylon*, is applied to burns and sore eyes.

In Brazil a decoction of the herb or of the fruit is used as an injection in inveterate gonorrhœa.

In Northern Nigeria the leaves, along with natron and bran, are given to horses for internal troubles. Similarly in Sierra Leone the seeds are mixed with Guinea-corn and given to horses for worms, and constipation.

Agolo : Abali oicha—; *Aguku* : Abali ilenza—; *Akim* : Betekuo—; *Antsianaka* : Besofimbavy, Besofinantanana—; *Bakwiri* : Toli—; *Bengal* : Buno-kra—; *Betsileo* : Besofina, Kihasinkasina—; *Bombay* : Nichardi—; *Brazil* : Carapicho, Carapicho da Calçada—; *Ceylon* : Aaiyooldi—; *English* : Paroquet Burr—; *Ewe* : Bobui—; *Goa* : Tupsado—; *Gujerat* : Jhipato—; *Hansot* : Bharvado—; *Hausa* : Danka 'dafi, Suren fadama—; *Hindi* : Banokra, Chikti, Chiriyari—; *Hova* : Tsindailay, Tsitiomoty—; *Ibo* : Udo—; *Ijebu* : Epafo—; *La Réunion* : Hérisson blanc—; *Madagascar* : Besofina, Tsindailay—; *Marathi* : Jhinjhira, Jhinjudi, Kutrevandare, Nichardi—; *Matheran* : Necharda—; *Mauritius* : Herbe à panier, Hérisson blanc, Aadaye otti—; *Mende* Chobwe, Chohobwe, Sogbe, Sogbei—; *Mundari* : Mindiat, Mindilata—; *Onitsha* : Udo mberi—; *Owerri* : Azuro, Azu uzo, Oke udo, Udo mberi—; *Sakalave* : Kisalenjy, Tsirriy—; *Sanskrit* : Jhinjhara, Jhinjhrita, Jhinjhurdi, Jhurpata, Kantaphali—; *Sinhalese* : Epala—; *Tamil* : Ottupullu, Puramutti—; *Telugu* : Chirusitrika, Tutturubenda—; *Timne* : Agbint-marabana, Egbun-temoer, Elkboentemoer—; *Twi* : Petekuku—; *Umu Ahia* : Ngbo—; *Uriya* : Bojoromuli, Jotojoti—; *Wolof* : Doupereit—; *Yoruba* : Ako-bolobolo, Boko-pupa, Haşa-omde—; *Zulu* : inDolaencane, iNorthwane—.

2. *Triumfetta semitriloba* Linn. is a tropical weed.

The leaves and fruit are mucilaginous and astringent.

The leaves are used in parts of Sierra Leone as a medicine for dysentery. In Cameroons a cold infusion of the leaves along with those of *Microdesmis puberula* is taken as a remedy for diarrhoea.

In Brazil a decoction of the herb or of the fruit is used as an injection in inveterate gonorrhœa.

Aguku : Agamevumawo—; *Ashanti* : Mfo—; *Bakwiri* : Toli—; *Brazil* : Carapicho, Carapicho da Calçada—; *Cameroons* : Okon, Okung—; *Duala* : Wonge—; *English* : Burweed—; *Ewe* : Bobui—; *Ibo* : Udo, Udo ji—; *Koranko* : Segbe—; *Limba* : Ubama-wuyeremi—; *Mende* : Bongewuli, Bonhui, Chobwe, Kpolohui, Kponhui, Pohui, Sogbe—; *Nzima* : Egurie—; *Onitsha* : Udo umuaka—; *Owerri* Udo umuaka—; *Tagalog* : Calotang-bilok, Colotan—; *Timne* : E-boloni, Kabolosi, Ka-bononi, Raka—; *Visayan* : Daracot—; *Yoruba* : Esura—.

TIGER SHARK—*GALEOCERDO TIGRINUS* MULLER AND HENLE.

Feeding and Breeding Habits.

BY

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(With three plates).

An opportunity to amplify the existing morphological description and other characteristics of *Galeocerdo tigrinus* was afforded to the author during work on the extraction of oil from livers of sharks and rays. The tiger shark is fairly common off the Bombay, Ratnagiri and Kanara coasts. It is one of the terrors of coastal fishermen, who dread it on account of its extensive predations and the severe havoc it causes to their nets, often entailing loss of their entire catch. Fishermen do not go in deliberate quest of the fish, as there is no shark industry in our Province. Whenever it is caught, it is accidental, being due solely to its being enmeshed in the nets. The fish feeds indiscriminately and voraciously on most of our edible fishes such as pomfrets, eels, ribbon fishes, etc. This fact has been amply borne out by an examination of its stomach contents. The shark is generally common from November to May and is taken at a depth of 6 to 10 fathoms while attacking nets with edible fish.

No systematic record of its life history is at hand and this deficiency, the author thought might partly be filled by a detailed information of its external characters, feeding and breeding habits, so that it may contribute to a fuller knowledge of an important member of the elasmobranchs which visits our coast.

Family ... **CARCHARHINIDAE.**

Genus ... ***Galeocerdo* Muller and Henle.**

Species ... ***Galeocerdo tigrinus* Muller and Henle.**

Local names:—*Waghbeer* or *Waghsheer*.

(Plate 1. Fig. A.).

Description:—The genus *Galeocerdo* is characterised by the presence in both jaws of large, compressed and sub-triangular teeth, denticulated and externally notched. Each of the denticulations possesses serrations on its edges. The presence of such teeth, together with the presence of minute spiracles, labial folds and prominent subcaudal pits, singles out this genus from the remaining genera of the family Carcharhinidae. The shark is locally known as *Waghbeer* or *Waghsheer*, a name which describes the tiger-like

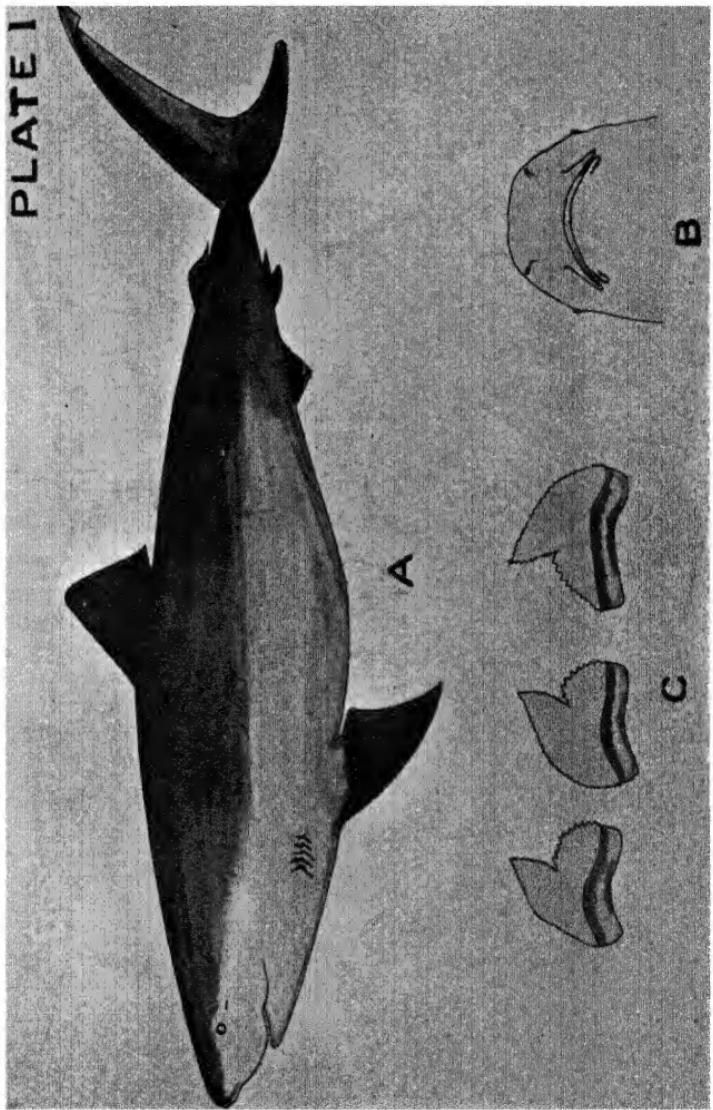


Plate 1:—Tiger shark, *Galeocerdo tigrinus*. A, female 13 ft. 1 in. long landed at Sarssoon Dock, Bombay; B, undersurface of head; C, typical teeth of same.

markings on the individuals of this species in young stages. The snout is shovel-shaped, with a rounded outline. The length of its preoral portion is slightly less than half the width of the mouth and nearly 1/3rd that between the eye and the first gill opening. The width of the snout beyond the nostrils is less than the general width of the head. There are grooves at the angles of the mouth, which extend along both jaws for a considerable distance, that on the upper jaw being nearly thrice as long as that on the lower (Plate 1, Fig. B). Nostrils, with distinct, triangular flap-like valves are situated on the borders of the snout, rather nearer its tip than the apex of the mouth. The eyes, of a moderate size, are oval in outline, with dark iris and rounded pupils. The spiracles are small and oval and are situated behind the eyes at a distance which is nearly twice the horizontal diameter of the orbit. Each gill slit is almost thrice the size of the eye.

Teeth: $\frac{21-24}{21-24}$. They are triangular in outline, with broad

bases and with notches on their outer borders. The borders of the teeth are broadly serrated and each of the serrations has still finer serrations. The teeth on the upper jaw are slightly bigger than those on the lower (Plate 1, Fig. C).

Fins:—The pectorals are falciform in outline and extend to beneath the hind end of the base of the first dorsal fin. The outer edge of each is four times the inner. The first dorsal originates slightly behind the axil of the pectoral. The second dorsal originates very slightly in advance of the anal and is a little bigger than that fin. The caudal fin is nearly one-fourth the total length, with a well-developed subcaudal lobe. Two prominent keels run along the lateral borders of the trunk, beginning some distance behind the pelvic fins. Also, a prominent mid-dorsal crest starts behind the first dorsal and ends slightly ahead of the second dorsal.

Colour:—Bluish or yellowish grey above and white on the side and beneath, tinged with pink. The dorso-lateral surface in adults is marked by faint vertical bars or stripes. These markings fade with age and then the colour appears to be grey above and white underneath. Even then faint, dark, rounded spots may be discernible on the sides of the caudal blade. The newly born young, however, are pale grey, marked with dark, more or less vertical bars all over the dorsal surface and over the dorsal fins.

Size:—This shark attains a great size. Individuals measuring from 8 ft. to 13 ft. in length and weighing from 500 lb. to over a ton are frequently landed all along the western coast, from November to March.

Habitat:—Red sea, seas of India to Japan and beyond.

Feeding habits:—The shark is a nomad of the waters that surround our subcontinent—a fact which is evidenced in its wide geographical distribution. It feeds on smaller sharks, fishes like eels, pomfrets, black pomfrets, ribbon fishes, silver bar fishes, mullets, etc. and prawns and crabs. It also feeds on rotting carcases and other offal. Two sea snakes were taken from the stomach of a specimen landed at Ratnagiri, while a turtle (*Chelone*

mydas), wholly intact, was found in the stomach of one caught in Bombay waters. The diversity of diet is well illustrated by an enumeration of the motley creatures found in a shark landed at Bombay on 17-1-1942. The shark which measured 13' 1", had a most amazing miscellany of food recently swallowed, consisting of

Five white pomfrets	...	<i>Stromateus cinereus</i>
One black pomfret	..	<i>Stromateus niger</i>
Karli	..	<i>Chirocentrus dorab</i>
Palla	..	<i>Clupea ilisha</i>
73 Ribbon fishes	..	<i>Trichiurus savala</i>
Koth	..	<i>Sciaenoides brunneus</i>
Mandeli	...	<i>Coilia dussumieri</i>

and a large quantity of prawns, crabs, squids etc.

The pomfrets secured from the shark's stomach were completely whole and wholesome, so much so that the fishermen washed them and sold them to the local dealers. Their appearance was such that none would have hazarded the view that they had been recovered from a shark's stomach (Plate 3, Fig. A). Swallowing of fish complete and un torn by such sharks is also commented on by G. P. Whitley, who writes as follows—

'It would seem that the tiger shark is not a fierce or voracious man-eater, but a quiet scavenger which approaches its food and swallows it without tearing it in pieces, but it is perhaps not safe to judge too far from habits in captivity.'

The list of fish taken from its stomach clearly indicates the enormous havoc wrought by this shark with consequent loss to our fishermen. Unfortunately, the intensity of this menace cannot be abated in our Presidency in view of the total absence of a shark fishing industry, which would automatically have the effect of reducing the depredations of these monsters and minimising loss to the fishermen. Local fishermen catch sharks only incidentally while fishing for other varieties of fish for the market.

Describing its mode of feeding, Dr. Jerdon, a keen observer of Indian fishes, notes that:—

'this shark swells itself out so as to look like a floating mass of animal substance and having thus decoyed its prey, it immediately attacks it.'

Our fishermen, too, have observed this shark swelling out into a sort of floating mass but have been unable to explain its significance. To this extent, Jerdon's observation appears to be correct.

The tiger shark is known to attack man, and recently there was a report from Malwan, on the Ratnagiri coast, of a man being attacked and killed by one. The fishermen recognised the assailant as 'waghbeer'. This shark also works havoc among fishermen's nets which are often carried away by it.

Economics :—The shark is fairly important from an economic point of view. Its liver yields a high percentage of oil of fairly good vitamin A content, having a vitamin potency from two to three thousand Blue units per gramme. The maximum weight of liver recorded was 150 lb., which yielded 10 gallons of oil. The livers of adult sharks are not eaten, but those of newly born young

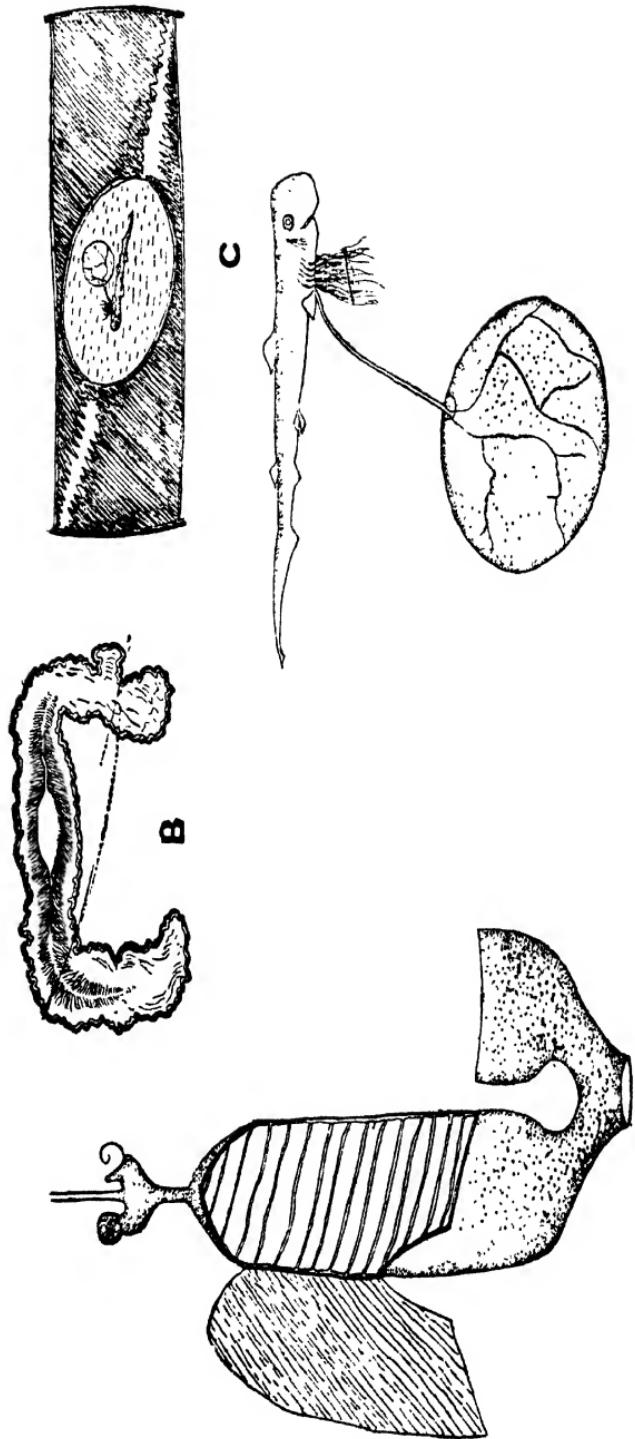


Plate 2.—A, uterus partly opened to show arrangement of compartments; B, compartment showing embryo within the water-filled sac in the shell membrane; C, compartment showing embryo within the shell membrane; D, embryo 6.8 cms. long with its umbilical cord and large yolk-sac. Note filaments in gill slits and spiracles.

ones are considered a delicacy by fisherfolk. The flesh is salted and consumed in inland districts and is considered exceedingly nourishing. The fins of this shark are not of much value.

Breeding habits (early stage)

Large females from 10 ft. to 13 ft. long and bearing from 26 to 44 young ones are frequently landed in Bombay. A female measuring 12 ft. in length and weighing about 800 lb. was landed at Sassoon Dock on December 15, 1941. Examination of the fish revealed that it was pregnant, both uteri being well developed, elongated structures, occupying nearly the whole of the abdominal cavity. Both ovaries were present, but did not contain prominent eggs. The oviducts were short and the nidamental glands, which were situated nearer the uteri, consisted of two coiled horns each, one of the horns being directed posteriorly and the other anteriorly. The uteri were long bag-like structures, not very broad and had thin vascular walls. They opened by a common aperture into the cloaca.

Structure of uterus and disposition of embryos.

(Plate 2. Fig. A).

The outermost epithelial coat of the uterus and the fibro-serous coat next to it can easily be separated from the highly vascular spongy coat, which contains greatly relaxed circular muscular fibres. The uterine wall being carefully cut through, each uterus is seen to be divided by transverse partitions into about 22 transverse compartments. The mucous membrane lining the compartments is very highly vascular. The embryo in each compartment is placed rather obliquely, enclosed in a thin and rounded sac formed within an elastic, yellow, iridescent shell-membrane and filled with a watery liquid in which it floats freely. In front of and behind this sac, there are two brownish yellow, wrinkled tufts, formed by great folding and plaiting of the shell membrane.

Only 18 out of the 22 compartments of the above-mentioned female contained developing embryos, while four contained unfertilised, spindle-shaped eggs enclosed in thin pouches of the shell-membranes. Both the embryos and the unfertilised eggs, together with their shell-membranes, were closely examined in the laboratory.

Shell membranes and unfertilised eggs.

(Plate 2. Fig. B).

Eggs that escape fertilisation receive the same treatment from the nidamental glands as fertilised eggs. These are spindle-shaped, transparent, gelatinous structures enclosed in shell membranes and lie obliquely in compartments in the same manner as the embryos. Tufts of the shell membrane are present, and on these being stretched out, the membrane extends into a thin, long quadrangular sheet, in the centre of which a spindle-shaped sac is seen to be present. This has thin, transparent walls derived from the laminae of the membrane. When the upper wall of the sac is carefully removed, a transparent, gelatinous, albuminous substance is seen surrounding a small quantity of pale yellow yolk in the sac. This substance and a little of the yolk also extend into the ends of the

spindle. There is, however, no watery liquid in these sacs as in the sacs containing embryos. It is possible that the watery liquid in the sacs containing embryos originates from this gelatinous albuminous substance

Shell membranes and embryos.

(Plate 2. Fig. C).

The wrinkled and plaited tufts of the shell membrane enclosing the embryo are stretched out and the membrane spreads out into a long, thin, elastic, hyaline and transparent quadrangular sheet, in the centre of which there is a thin-walled sac filled with a watery liquid. In this, the tiny embryo, with its umbilical cord and yolk-sac, floats freely. The upper wall of this central sac is seen to be formed by a very thin lamina rising from the centre of the shell-membrane.

EMBRYOS.

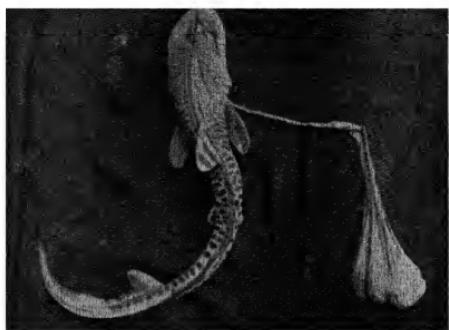
(Plate 2. Fig. D).

Dimensions:—

- (a) Total length of embryo—6.8 to 7.5 cms.
- (b) Length of the caudal fin—1.8 cms.
- (c) Length of longest branchial filament—2.5 cms.
- (d) Length of umbilical cord—4.3 cms.
- (e) Diameter of yolk-sac—5.6 cms.
- (f) Length of filament in spiracle—1.1 cms.

The embryos are semi-transparent, pale white or ivory, partly suffused with crimson, and have loose membranes hanging in the region of the fins. The myotomes can be seen through the transparent skin covering them. All the external features seen in the adult are developed, but are in a rudimentary condition. The head region is rounded and swollen dorsally, and the divisions of the brain can be seen through. The region of the snout in front of the mouth and below the swollen brain region is rounded in outline, its length being nearly equal to the width of the mouth at this stage. Large prominent eyes, with sparsely pigmented iris, are situated on the lateral margins of the head. Some distance behind the eyes are situated tiny spiracles, rounded in outline as contrasted with the oval spiracles of the adult form. Through each spiracle issues a bunch of crowded filaments similar to the branchial filaments. The presence of such filaments in the spiracles of early embryos suggests the possibility that they, too, may be serving the same function as the branchial filaments, viz. of absorbing the liquid in the sac, which is probably nutritive in nature.

A bunch of crowded, crimson-coloured branchial filaments issues from each gill slit. Rudiments of all the fins are present, these being mere membranes, only partially covering the fin rays. The pectorals arise behind the last gill slit. The first dorsal fin is situated midway between the pectorals and the pelvics. The second dorsal and the anal fins are opposite each other. The sub-caudal lobe is not well developed. The umbilical cord pierces the abdominal wall between the pectoral fins.



A



B

Plate 3 :—A, embryo with yolk-sac and umbilical cord (advanced stage). Note conspicuous tiger-like markings; B, 42 embryos each weighing 1 lb. are seen spread out along the mother's body. The white bag on the left is the shark's stomach from which were taken several basketsfull of miscellaneous and quite fresh fish (Inset top right).

Yolk-sac :—This is a massive rounded bag, filled with heavy yellow yolk, and its walls have well developed blood capillaries which continuously unite to form larger vessels. A transparent, gelatinous disc is present at the upper pole of the yolk-sac. A single prominent vein courses vertically up along the yolk-sac wall towards the disc, and two horizontally placed arteries unite to form a single artery, so that it and the single vein eventually emerge from the disc to pass into the umbilical cord. Between these two vessels can be discerned passing upwards a very minute prolongation of the sac, and this represents the yolk-duct. The yolk-sac is enclosed in a very thin envelope of connective tissue which is continued over the umbilical cord.

Umbilical cord :—This structure originates at the upper pole of the yolk-sac and terminates by piercing the abdominal wall of the embryo between the pectoral fins. The cord consists of the umbilical artery, the umbilical vein and the yolk-duct between the two. The vein and the artery are formed by the union of the venous and arterial capillaries respectively, ramified in the mesoblastic tissue of the yolk-sac wall, while the yolk-duct is a mere prolongation of the sac conducting yolk granules. All these three structures are enclosed in a gelatinous, tubular sheath, which, in turn, is covered over by a prolongation of the connective tissue covering the yolk-sac. There are no appendicula on the umbilical cord. The exact arrangement of the umbilical vessels in the body of the embryo cannot be made out, but the yolk-duct is seen to give rise to an internal yolk-sac which joins the upper end of the colon on its dorsal aspect.

BREEDING HABITS. (Advanced stage).

(Plate 3, Fig. A).

An outsize female, weighing over a ton, was landed at Sassoon Dock on January 17, 1942. It contained a liver weighing approximately 150 lb. The monster was captured as it was attacking the bag end of a 'dol' net in which a great quantity of fish had been trapped. The shark was dead by the time it was landed. Its dimensions were as follows:—

(1) Total length from tip of snout to tip of tail	... 13 ft. .1 in.
(2) Length of caudal fin	... 3 ft. .2 in.
(3) Girth round widest part of body	... 6 ft. .8 in.
(4) Width at angles of the mouth	... 21 in.
(5) Length of preoral portion of snout	... 6 in.
(6) Distance between the eye and spiracle	... 2.75 in.
(7) Distance between the eye and the first gill opening	... 16.5 in.

Both the uteri in this female were distended structures occupying the entire length of the abdominal cavity. The ovaries were rather small and did not contain ripe ova. The oviducts were short.

The wall of each uterus is rather thin. The spongy coat is highly vascular and the circular muscle coat not very prominent. On carefully cutting through these, the transversely placed uterine compartments come into view. The mucous membrane in each com-

partment is almost purplish crimson in hue, being highly vascular. Each compartment contains a large water-filled sac enclosing the embryo with its attached structures, viz., the umbilical cord and the yolk-sac. These water-sacs, which are formed within the shell-membranes, now assume such proportions as completely to obliterate the proximal and distal plaits and folds of the shell membrane present in the early stages of the embryonic development. A slight tilting of these sacs causes the embryos, with their attached structures, to move freely in the liquid, thus showing that the yolk-sacs do not enter into any connection with the maternal tissue.

Each uterus of the aforesaid female contained 21 well developed embryos, but only one embryo out of the 42 was under developed and had undergone degenerative changes. Of the remaining 41 embryos, 30 were female and 11 male.

EMBRYOS.

(Plate 3. Fig. B).

<i>Dimensions</i>	<i>Male</i>	<i>Female</i>
1. Total length ...	20.5"	19"
2. Length of the caudal fin ...	7.5"	7.25"
3. Length of the umbilical cord. 5.5"	...	5.25"
4. Diameter of the yolk-sac. 3.75"	...	4.75"

The embryos at this stage are almost fully developed, but differ from the parent fish in having a totally different dorsal colouration and possessing the umbilical cords and yolk-sacs. The embryos possess the following morphological characters.

The snout is semicircular in outline, its preoral portion being slightly more than half the width of the mouth. The nostrils, with triangular valves, are situated midway between the tip of the snout and the apex of the mouth. The groove along the upper jaw is thrice as long as that on the lower, and extends below the anterior margin of the orbit. The spiracles are situated behind the orbits at a distance of about one-third the orbital diameter. The gill slits are without branchial filaments. The pectoral fin originates below a point slightly in front of the fourth gill slit. The first dorsal originates behind the posterior end of the base of the pectoral, and its hind tip does not reach the origin of the pelvic. The second dorsal originates slightly in advance of the anal. The bases of both these fins are nearly equal. The anal is situated midway between the posterior end of the base of the pelvic and the root of the caudal. The caudal fin is about one-third the total length of the embryo.

Originating behind the skull and extending backwards on either side of the mid-dorsal line are two keels which assume a lateral position, a short distance ahead of the second dorsal, and continue behind as the lateral keels. In the region of the caudal fin, they turn upwards and continue on either side of the caudal blade. A narrow groove extends from behind the base of the first dorsal and stops short in front of the origin of the second dorsal. The scales are sparingly set all over the body.

Colouration :—The head is grey. Roundish or oval black spots are visible behind the skull. The dorsal surface of the body is marked by black stripes or curved bars. There are dark transverse bars on the first dorsal, and the top of the second dorsal is black. Below and behind the second dorsal are darkish oval spots, above the lateral keels, and these spots become rounded on either side of the caudal blade. The upper margin of the caudal fin is light in colour, but the lower is darker. The ventral surface is ivory, as are also the pelvic and anal fins, although their tips show a very faint grey pigmentation.

The Yolk-sac :—The yolk-sacs, are fairly big and contain a considerable quantity of yellow, granular yolk in the lower parts. Their walls are highly vascular, and the superficial blood capillaries in some of the yolk-sacs run parallel to one another, coursing vertically upwards. The capillaries ultimately join to form the umbilical vessels. At the upper pole of the yolk-sac there is a slight bulge, marking the beginning of the umbilical cord. The large size of the yolk-sacs with plenty of yolk yet left in them, the absence of any trace of foldings on their walls distally and their free positions in the water-filled sacs containing the embryos, point to the possibility that a yolk-sac placenta is not at all formed in this species, and that nutrition is supplied to the developing embryo in the form of yolk throughout its intra-uterine life.

Umbilical cord :—It consists of the vitelline duct, the umbilical artery and the umbilical vein, enclosed in a smooth tubular sheath of connective tissue reflected from the outer layers of the yolk-sac walls. On carefully opening this sheath, it is seen to contain a certain amount of a dark-brown or reddish serumlike liquid in contact with the vessels. This liquid is also found in the bulge at the top of the yolk-sac. It is probable that the yolk is converted into this liquid, which is finally absorbed by the umbilical vein and carried into the hepatic portal system of the embryo.

The vitelline duct is seen to open into a fairly big internal yolk-sac lying on the dorsal side of the colon and opening into it dorsally, at its upper pole. The size of the internal yolk-sac is found to vary inversely with that of the external yolk-sac, being larger when the yolk in the external yolk-sac is small in quantity and vice versa. The umbilical vessels are traced into the body of the embryo, and the vein is seen to join the hepatic portal vein before the latter bifurcates to enter the hepatic lobes, while the umbilical artery is seen to course along the posterior wall of the upper end of the internal yolk-sac to become the continuation of a branch of the coeliaco-mesenteric artery, the other branch of which supplies blood to the posterior wall of the small intestine.

Comparison of the two embryonic stages of *Galeocerdo tigrinus* reveals the following noteworthy points :—

(1) In both stages of development, the embryos are enclosed in water-filled sacs formed in the shell membranes.

(2) The very small size of the embryo in the early stage necessitates great plaiting and folding of the shell-membrane both proximally and distally, whereas in the later stages the well-grown

embryo requires the covering of the entire shell-membrane, so that the proximal and distal foldings disappear.

(3) The branchial filaments are present in the earlier stages and their function appears to be to absorb the liquid in the sac, which is probably nutritive in value. The same function may be assigned to the filaments in the spiracles. In the later stages the branchial filaments as also the filaments in the spiracles are no longer present and the function of nutrition is carried out by other well developed structures, namely, yolk duct and the umbilical vessels.

(4) The embryos in the early stages are of a pale ivory colour, no pigmentation being present. In the later stages, however, pigmentation is perfect and the dorsal colouration of the embryo is characteristically tiger-like.

(5) No trace of a serum-like liquid is noticeable when the umbilical cord is slit open in the earlier stages, whereas a reddish serum-like liquid can be seen lying in contact with the umbilical vessels when the sheath of the cord is opened in the later stages.

INFERENCES.

(1) The embryos of *Galeocerdo tigrinus* grow to a large size (nearly 2.5 ft. in length) before birth. At birth they have conspicuous tiger-like markings on their bodies.

(2) Extra protection seems to be afforded to the developing embryos by their envelopment in sacs filled with a watery liquid. The liquid must probably also be having a nutritive function in the earlier stages, at least, of the embryonic development.

(3) The large quantity of yolk in the yolk-sac appears to nourish the embryo throughout its intra-uterine life. Further, the absence of any folding of the yolk-sac wall even in the advanced stages of development and the free position of the embryo in the uterine compartment seem to suggest that a yolk-sac placenta may not at all form in the tiger shark.

ACKNOWLEDGMENT.

My best thanks are due to Dr. S. B. Setna, the Fisheries Officer, for his valuable guidance and criticism, both in the field and in the laboratory. He suggested the problem and the entire work was done under his supervision.

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A REVIEW

REPORT OF THE GAME AND GAME FISHES PRESERVATION COMMITTEE ON THE EXISTING SPECIES OF GAME IN BENGAL. Compiled by L. R. Fawcett, Esq., C.I.E., I.C.S., Pages i-iv+i-ii+1-53, Superintendent, Government Printing, Bengal, Government Press, Alipore, Bengal, 1943. Price—Indian, Rs. 3; English, 5s. 3d.

The members of the Society and lovers of sport all over the world will be greatly interested to learn of the publication of the Report under review. The gradual decline of game in the Bengal 'shikar' areas, the likely chances of its reaching the vanishing point, and the concern felt by the Bengal Government in this matter, led to the appointment of the above mentioned Committee with the hope of finding means to arrest this decline for the benefit of future naturalists and sportsmen. At the outset, the Committee felt that it will be profitable 'to take stock, so far as we can, of the game which still remains in Bengal and though no exact census is obviously possible, this Committee has done its best to gather from those¹ best able to give it, as accurate information as possible on the existing distribution in Bengal of the animals, birds and fish which are conventionally known as game'. In the absence of precise definition of game animals, treatment of certain species, which the sportsman may not call game but which those with love for natural history would look on with interest, has also been included. No attempt has been made to compile a catalogue of names or give technical descriptions of species, but, section by section, some account is given of the game found in Bengal today, together with information of their numbers, habitat and distribution. The Committee has generally avoided to give exact specification of localities so as to save destruction of game by pot-hunters in Bengal.

The first section of the Report deals with animals (mammals) such as Greater and Lesser Cats; Civets and their relatives; Mongooses; Hyaena; Dog Family; Weasels, Otters and Bears; Rodents; Wild Elephant in Bengal; Rhinoceros in Bengal; Bison and Buffalo; Serow and Goral; Antelopes and Deer; Pigs; and Pangolins.

A treatment of Birds is given in the 2nd section and such forms are dealt with as Pigeons and Doves; Sand Grouse; Peacocks and Pheasants; True Quails and Partridges; Button Quails; Rails, Cranes, Bustards and Floricans; Plovers, Snipe and Woodcock; Ortolans; Ducks and Geese of Bengal; and Semi-Sporting Birds.

In the 3rd section larger Reptiles, such as Crocodiles, Python and Monitor Lizards, are dealt with, while the final section, dealing with the Game Fishes of Bengal, contains an account of the three Himalayan species of Mahseer, Katli, Indian Trout and Goonch. A key to the three species of Mahseer is given and their main distinguishing features are explained with the help of illustrations.

The Report under review shows clear evidence of having been based on extensive material, which has been carefully sifted and ably edited. The thanks of sportsmen and naturalists are due to the Committee and especially to Mr. L. R. Fawcett, who compiled the Report, for the production of such a useful and interesting work.

The volume is nicely bound in the usual style of Government publications. The printing and general get-up do considerable credit to the authorities of the Bengal Government Press. A few typographical mistakes have been noted but they were perhaps unavoidable in a compilation of this nature.

S. L. H.

¹ Sub-Section of the Report dealing with 'Elephants and Rhinoceros' was contributed by Mr. T. V. Dent, I.F.S., that on 'Ducks and Geese of Bengal' by Mr. W. A. S. Lewis, I.C.S., and the one on 'The Game Fishes of Bengal' by Sunder Lal Hora, Director of Fisheries, Bengal.

OBITUARY

We regret to announce the death in England of Mr. Hugh Whistler, the well-known ornithologist—author of *A Popular Handbook of Indian Birds*—early in July, 1943. A fuller obituary notice will appear in a later issue.

MISCELLANEOUS NOTES

I.—THE RECORD SKULL OF AN INDIAN CLOUDED LEOPARD (*NEOFELIS NEBULOSA* GRIFFITH).

Although in Rowland Ward's Records for 1935 skin-measurements of the Clouded Leopard are entered, no mention is made of the skulls presumably because they were considered to be of no interest to Indian sportsmen. Since some of the readers of the *Journal* may be interested in the subject, I give the conventional dimensions of the skull of an adult ♂ from Assam which appears to be a little longer than any skull of which the measurements have hitherto been published. It was figured by Gray in 1867, by Blanford in his *Mammals of British India*, p. 73 and by myself in vol. i of my edition of this work, p. 247, 1939. The skull itself, however, was not available to me when I drew up the table of measurements (p. 252). In that table the largest specimen entered was an adult ♂ from Nepal which is appreciably shorter. But in the Appendix to vol. ii of the same work, 1941, p. 475, I gave the dimensions of an adult ♂ from Sumatra which exceeded the Nepal skull.

In the following table the length and breadth of 4 skulls are entered in English inches and in millimetres, the latter being in brackets:—

Locality		Total length	Zygomatic width
Assam (Zool. Soc.) ad. ♂	...	7 $\frac{1}{2}$ (192)	4 $\frac{1}{2}$ (121)
Nepal (Hodgson) ad. ♂	...	7 $\frac{1}{2}$ (180)	4 $\frac{1}{2}$ (121)
Tista, Sikkim (Frost) just ad. ♂	...	6 $\frac{1}{2}$ (167)	4 (102)
Sumatra (Frost) ad. ♂	...	7 $\frac{1}{2}$ (190)	4 $\frac{1}{2}$ (125)

It may be noted that the two largest skulls are longer than the ♂ skull of a Snow Leopard entered on p. 242 of my vol. i and longer than several ♀ skulls of Panthers entered on p. 230.

BRITISH MUSEUM (NAT. HIST.), R. I. POCOCK.

LONDON, S. W. 7.

September 11, 1942.

II.—ELEPHANT AND BISON ON ROAD WAYS.

Two incidents recently occurred on the Ghat Road leading down from the Billigirirangan Hills. The first in connection with elephants and a cart-bull, and the second a solitary bull bison—obviously sick—and a motor car.

(1) A single cart-bull had been trotting in front of a car travelling from the Estate down the Ghat for some way, and eventually the

car was stopped and H., a visitor to Honnametti, got out and ran after the bull in the hopes of turning it off the road. On rounding the corner an extraordinary sight met his eyes:—An elephant group—a bull and 2 cows and a calf, had just come on to the road, and as the cart-bull trotted up to the party the 2 cows put their heads together and without hesitation pushed the cart-bull off the road down into the long grass below. Luckily it was not much of a drop and the cart-bull appeared to suffer no harm!

(2) While motoring up the road to Honnametti my wife came on a solitary bull bison walking slowly up the road in the same direction. The bison appeared to take no notice of the car behind it but heaved from side to side as though very ill. On my wife sounding the horn, however, the bull turned round, lowered its head and advanced slowly towards the car. The car was reversed none too steadily however and went into the bank! The bull had in the meantime turned again and proceeded to walk up the road once more. It turned and repeated the performance every time the horn was sounded. Eventually the bull turned the corner and my wife gave it about 10 minutes before following slowly in the car, only to find the bull waiting expectantly round the corner facing her with its head down. Reversing back round the corner, my wife waited for about 20 minutes before proceeding slowly forward again by which time the bull had left the road and could be observed moving slowly through the long grass below, every now and again staggering from side to side and giving every indication of suffering from either a severe wound or disease. One may assume that sick as it was, the bull would have attacked the car, had my wife not reversed on each occasion; and had those in the car not realized that the bull was definitely not in its normal condition, the incident might have given rise to a record of another instance of an unprovoked attack by an unwounded bull bison.

C/O BASE POST OFFICE,
CEYLON.

R. C. MORRIS,
Lt.-Col.

March 23, 1943.

III.—OCCURRENCE OF THE HIMALAYAN TAHR (*HEMITRAGUS JEMLAHICUS*) IN SIKKIM.

As little appears to be known about the distribution of the Himalayan Tahr (*Hemitragus jemlahicus*) in the eastern part of its range, the following note may be of interest.

Unfortunately I lost my shikar diary during the withdrawal from Libya last year and this note is written from memory only, so the details as to elevations, distances, etc. may be slightly erroneous, but the main facts are correct.

In November 1939, while waiting to join up, I decided to fill in time with a shooting trip in Sikkim as I was already living in the Darjeeling district, the original object being simply to bag a Burchel (*Pseudois nahoo*).

While discussing passes etc. with the political officer at Gangtok, I was told that earlier in the year a German Natural History Expedition, from I think, Munich, had discovered 'a new kind of

animal on the slopes of Kancheng-junga'. This animal was described as a sort of goat or sheep and went by the local (Lepcha) name of 'shepi'. There was no mention of it in the Sikkim Durbar's list of game which may or may not be shot, and I could find out nothing more about it in Gangtok.

It did not at that time occur to me that it might be a type of Tahr, as the Tahr was not included in the above mentioned list either, and although I believe the Tahr is known to occur as far East as Bhutan, I had only heard of one case of its being reported from Sikkim which was many years ago somewhere in the Talung Chu. In any case a German Natural History Expedition would presumably have recognised a Tahr on seeing one, and would hardly have described it as 'a new kind of animal', though it must be admitted I only had this information at second hand.

The omission of the Tahr from the Sikkim game list may be due to confusion arising from the fact that in Sikkim and the Darjeeling district the local (Paharia) name for Serow (*Capricornis sumatrensis*) is 'tahr' and the Serow is included in the list.

I had more or less forgotten about the 'shepi' until I got to Chum Tang, a Lepcha village near where the Lachen and Lachung rivers join to form the Teesta; here I found one of the local Lepchas had joined the German expedition earlier in the year, and on enquiry he said he knew of the place where they had found the 'shepi', though he had not been with them at the time. It was many years since he had seen a live specimen himself.

My time and stores being limited, I pushed on to Thanga after Burhel but made arrangements for the Lepcha 'shikari' to go to the 'shepi' ground straightaway and to report to me on my return journey as to the chances of finding any.

On my getting back to Chum Tang about a fortnight later, the shikari met me and told me that after spending several days and nights in the jungle, he had located a flock of 'shepi'. The ground was apparently situated some distance up a small tributary, the Pim Chu, which joins the Lachen on its right bank about five miles above Chum Tang.

The next morning we set off for the 'shepi' ground, travelling light; the shikari, two coolies and myself. The distance from Chum Tang turned out to be only about ten miles but the going was very bad. A cattle path led along the bank of the Lachen for two or three miles, but after that there was no track at all and kukris had to be used frequently to cut a path through the jungle to allow the laden coolies to follow. In many places ladders had to be made out of tree-trunks to help them to climb up steep banks and rock-faces and over some of the enormous boulders which completely blocked the bed of the stream.

The range at the head of the Pim Chu is some 12,000 to 14,000 ft. in height and the valley floor slopes very rapidly towards the Lachen, with numerous water-falls in its course. The hills on either side are extremely steep and clothed in dense forest, but where the bed of the stream reaches about 7,500 ft., the forest stops abruptly and above this the banks on either side are positively precipitous, while above the precipices there are steep grassy slopes dotted with patches of scrub-jungle and stunted bamboos. The

whole area is cut up and broken by old land-slips and the surface is mostly very loose and gives but poor foot-hold. The rain fall during the monsoon must be fairly heavy, and at the time of year that I was there (early December) the sun never penetrates to the valley floor, leaving it cold and inhospitable.

By about 3 p.m. we had almost reached the point where the jungle ends and the precipices begin, and as there is no flat ground or water available except in the bed of the stream, we decided to camp there on a patch of sand between the boulders, in spite of the obvious chilliness of the place. There was no alternative anyway!

The Lepchas proceeded to build themselves a lean-to out of branches and leaves, backed by a large rock, and I had a forty-pound wind-proof tent. While putting up the latter the shikari suddenly said, 'There they are!' and pointed towards the grassy slopes further up the opposite (North) side of the valley. I could hardly believe him, as I was under the impression that we should have to go considerably higher before finding any 'shepi', but on examining the slope through my binoculars, I could certainly make out two or three black animals grazing at the top of one of the cliffs. I was still somewhat sceptical however and thought they were probably only Serow after all, as we had noticed plenty of Serow tracks in the jungle on the way up from Chum Tang, but the Shikari swore that they were not Serow ('Tahr' in his language), but 'shepi'.

It was too late to begin a stalk that evening and the same night I had the misfortune to develop an attack of dysentery.

The next morning we could see no 'shepi' from the camp, so we climbed up through the jungle on the north side of the Pim Chu, and by about mid-day, reached the top of a rock slab overhanging the slopes on which the 'shepi' had been grazing the previous evening; the only living thing to be seen however, was a cock monal pheasant (*L. refulgens*), and except for some tracks and droppings in the jungle, which might easily have been those of Serow, there was no sign of the 'shepi'. We had something to eat and were resting on the top of the cliffs, high above the floor of the valley, when three or four black objects appeared, but this time on the south side of the nullah, i.e., the side opposite to us, and well out of rifle-range. It was impossible to cross the valley at that point as the precipices on either side were quite unclimbable; the only way was to return to the camp-site some distance back down the valley and to cross there. There was not time to do this before dark, so we just had to content ourselves with waiting in the hope that something might turn up on the slope below our rock where we had seen them the evening before. Nothing appeared however, but I had a good view through my binoculars of the 'shepi' grazing on the opposite cliffs, and I watched them for a considerable time.

The following day we tried the cliffs on the south side and nearly got within range of a male with the best head I had so far seen, but the going was extremely bad and I was beginning to feel weak with dysentery; the result was that I dislodged a stone which

went bounding down the hill side and scared the 'shepi' who went off, with a shrill whistle of alarm, straight up the valley where the ground rapidly got worse, and we soon had to give up any attempt to follow them.

We were making our way back to camp in the late afternoon when five 'shepi' appeared on the far side of the nullah below the slope on which we had first seen them, but of course they were again out of range; I had another good view however.

We tried the north side once more the next day, but by then I was feeling decidedly groggy and could not move without sending showers of stones down the hill sides, and again the only 'shepi' we saw were on the opposite side of the valley.

The following day I was feeling slightly better, but provisions were running low, and as I still had a four-day trek back even to the comparative civilisation of Gangtok, and considering the state of my health, I thought it advisable to move back to Cham Tang, as I saw no more of the 'shepi'.

During my four days in the Pim Chu valley however, I had several good views of 'shepi' through field-glasses, and on one occasion without glasses, and I am convinced they are the same as the 'Tahr' of the Western Himalayas, or possibly an eastern race of the same species. The Lepcha shikari said they were the same kind of animals as the German Expedition had obtained. I personally saw at least eight 'shepi' and there may have been dozen or more inhabiting that part of the valley, but curiously enough, a friend of mine who visited the same spot with the same shikari some two months later, was unable to find any at all; the snow conditions would of course have changed by then; when I was there the snow was not lying below 10,000 ft., though it froze hard every night.

ON ACTIVE SERVICE,
April 1943.

C. J. T. WRENICKE,
Capt.

IV.—LIFE SPAN OF SOME WILD ANIMALS IN CAPTIVITY.

A Chital stag (*Axis axis* Erx) born in the Trivandrum Zoo in 1920, died of old age last December. For some time previous to its death it was showing unmistakable signs of old age. Veterinary examination also resulted in establishing old age as the cause of death. This deer has thus lived for 22 years. We have had others of the same species for periods ranging from 12 to 18 years. Would it be a record age for Chital in captivity, as it is so for this zoo?

Incidentally, similar records of the age of some other animals may not be out of place. In spite of the curtailment of freedom involved in keeping wild animals in captivity, it has been the experience of the staff of menageries and Zoological Parks, that most of the animals and birds live to a ripe old age. As we have no means to ascertain the span of life of animals in their wild state, it would only be possible to infer the years for which they would live, from the data available in zoos. Therefore, a few particulars

regarding the age of some of the animals kept here are added for what they are worth.

Mammals.—Among Primates, an Orangoutan (*Simia satyrus*) survived for 15 years, and a Black Ape (*Cynopithecus niger*) lived for 21 years. A Baboon monkey (*Papio hamadryas*) acquired as an adult, died after 22 years of captivity, while a Bonnet monkey (*Macacus sinicus*) died after 23 years.

There have been some long lived ones among the carnivora too. A lion, born here in 1919 died last year at the age of 23. Another, born in 1923 is still going strong. The recorded maximum age for tigers and panthers is 16.

We have not been able to ascertain the maximum age of the Himalayan Bear. One of this species, aged 10 at the time of acquisition has been here for the last 12 years.

An important loss which this zoo had to sustain a few months back was due to the death of a bull Giraffe (*G. camelopardalis*) imported from Africa in 1927. It was a full-grown one then probably 8 years old, and has lived here till September 1942 (15 years). Among other mammals, special mention may be made of a Porcupine (*Hystrix leucura*) and an Otter (*Lutra vulgaris*) both of which have completed 22 years of captivity. The former died in 1942 while the latter is still living.

Birds. A recent newspaper report mentioned a 150 years old Cockatoo of the London Zoo as one of the casualties during an air raid alert. We have had parrots living only for 33 years, not even attaining the half century. Eagles and vultures have lived for 40 years. An Australian Cassowary hatched out here 37 years ago is still living. Similarly a Hornbill (*Dicroides bicoloris*) purchased for the zoo in 1905 (37 years) and an Adjutant crane (*Leptoptilus dubius*) obtained in 1911 (31 years) are alive. A little Cormorant (*Phalacrocorax niger*) died only last week after a period of 21 years of captivity. A curious feature about this bird was that for a long time before its death it had lost the use of both of its eyes and had to be fed by its keeper. There is another cormorant of the same age. One of its eyes is blind, but it is still alive.

GOVT. ZOOLOGICAL GARDENS,
TRIVANDRUM,
January 12, 1943.

E. S. SIMON,
Curator.

V.—BREEDING SEASON OF THE INDIAN SAMBAR (*RUSA UNICOLOR*, KERR).

It has been mentioned about the Indian Sambar (*Journal Bombay Nat. History Society*, vol. xxxvii, No. 1 (1934), 'Wild Animals of the Indian Empire and the problem of their preservation', Part II, p. 77), that 'there is much variation both as to the pairing season and the time at which the antlers are shed'. Again on page 78 it is said that 'pairing takes place in November and December The young are born at the commencement of the rains in late May or early June'.

Though there may be regional variations, observations made of a herd of Sambar, numbering over two dozen kept in the Trivandrum Zoo, have tended to establish definite periods with no wide range, as regards the seasons for the shedding of horns, mating or birth of the fawns. The seasons for these differ from those mentioned above. Unlike other *Cervidae* which have been seen with young ones or with shed antlers at all seasons, all the Rusa deer stags were observed to cast their antlers in May. Pairing took place in late June and early July. A dead hind in mid-July last year, was found to contain a foetus of a few weeks development. Between the middle of December and the third week of January this year, eight young ones were born. Each hind has given birth to a single fawn and the period of gestation has been six months.

GOVT. ZOOLOGICAL GARDENS,
TRIVANDRUM,
January 21, 1943.

E. S. SIMON,
Curator.

VI.—SMALL GAME SHOOTING IN THE SALEM DISTRICT.

East of Salem, between the Shevaroys and the Chitteris and the hills to the South of them, a narrow neck of flat country broadens out into the great empty spaces which extend to the coast. At the eastern entrance to the gap, where thankfully there is always a welcome breeze a considerable variety of sport can be found with a scatter-gun, from jungle fowl in the hills to sandgrouse on the plains, and wild fowl on the tanks, all within a radius of five miles. By far the biggest item between October and March is wild fowl, which arrive in at times vast legions, until every tank (of which there are far too many) is solid with them. The impossibility of assembling flighting parties at the right moment, and the complete inadequacy of their strength when it could be arranged, was tantalizing with so many birds about, and many occasions went by when red-letter bags might have been made. I should like to know whether anyone has shot in this area in recent years. There were no indications of it, judging by the astonishment of the natives at our activities, local talk, and the inexperience of the duck themselves when we first started operations.

Before their arrival I had odd walks after sandgrouse. Only a few small parties inhabit the intermittent barren stretches of country, and there are too few, and too much water, to shoot them properly at flight. Two species occur, common and painted, the Common Sandgrouse predominating in the autumn, while after Xmas I saw only painted. They mixed together, and one 'doublet' I got out of a bunch of five contained one of each. Beyond the sandgrouse, only grey partridges which are common, presented a quarry, but not a sufficiently exciting one to justify the reduction of my previous ammunition supply. Jungle fowl are fairly abundant in the Chitteri Hills, but the organization required to shoot them in those impenetrable thickets did not make them a proposition. The snipe, too, were resisted, when they arrived early in October.

I was determined to save every round for the ducks. There were ten pintail to every common snipe and a few of those queer rail-like birds, painted snipe, which seem so inappropriately named. By now, thousands of migrants had arrived, most of them first seen in August, greens and wood sandpipers, Temminck's and little stints, stilts and greenshanks (grand to see old East Anglian friends again). But still there were no duck, beyond one or two dull pairs of spotbills.

At last on October 3, I saw three garganey and after a skilful drive by my batman I got one, and should have had two. However I had got a duck, my first East of Yarmouth! During the ensuing days pintail and garganey poured in. I erected a hide on the nearest tank and went out for an hour one evening with another gun on the next tank. The pintail flew well between us, and I got seven, but after a time they cleared off, and went and sat on the other tanks. This paltry effort obviously did not meet the case, and I attempted to mobilize every gun in the area and organize a proper flight. But naturally much success was not possible, and the largest party we ever mustered was five. With twenty large tanks, not more than a mile between each, we could not hope to keep the birds on the move and the story was always the same. After a grand hour at day-break, during which we had excellent sport, every duck disappeared to find more peaceful surroundings in which to pass the day only a couple of miles away. At each flight I increased the number of 'disturbers' on surrounding tanks, but to do the thing properly I needed twenty guns and fifty disturbers—for which I fear this shoot must wait until the 'piping days, etc.' But I recommend it to anyone then, if I am not here to partake myself (personally I hope it will be the desolate salttings of Essex, or the iced-fringed creeks of the Solway!).

The other problem was caused by the unsuitable nature of the tanks for shooting. They are large and round, with banks like golf greens: not a suspicion of cover. I put up the hides as far out as possible, but the duck were always near the middle, and just out of range, and not until I made my floating butt did I come to grips with them properly. This was an excellent answer, the butt being a simple construction of bamboo and petrol tins (now dutifully returned to their lawful occupation), tied together with string and covered with palm leaves. I cannot imagine why we never thought of this at home, where time and money has been spent building enormous erections on twenty-foot poles. When anchored, the new model is surprisingly steady, as a shooting platform, and is easily transported to any tank desired. It is the most important result of the season for me.

Garganey and pintail were the most common throughout. I saw only one cotton teal, on November 12, and on that day the first tufted duck, which were fairly common all the winter. One or two big flocks turned up at every flight, circling round obligingly and giving every one a crack before they made off. Teal appeared early in November, but there were never very many. There were no pochard, but I saw big flocks of red-crested pochard further

to the east and nearer to the coast a single pigeon, a young cock. I shot one shoveller and again he was the only one I saw, until four appeared on March 21. On October 15 an enormous flock of nukta flew by while we were building hides for next morning; it was their only appearance. All these were isolated incidents and the only birds permanently present were pintail and garganey, always in large numbers, and sometimes tufted and teal, and of course a few spotbills.

The duck effected a strange and total disappearance immediately after Xmas. Not a bird was to be seen during January and I assumed that our sport was over. But to my surprise and delight pintail and garganey appeared suddenly on February 5, followed by a few tufted and we had one perfect flight. I have no idea what caused their absence for six weeks, but in my experience at home such an event would merit some definite explanation. There was no drastic change in the water-level and nothing particularly interesting about the weather. I am at a loss.

Most of the duck remained until the end of February and I saw the last garganey on March 31.

Lastly the geese. Wild geese are my obsession, but I had never hoped to see any, as I assumed we were too far south to come within their range. There are no marshes and no big rivers, and as I associate geese with the gale-swept desolation of the waste and other similar scenes, I could never imagine them perspiring in the heat of the day round a circular tank. However I was elated to a degree to see thirteen bar-headed geese, with a dozen spoon-bills, on December 3. They were padding about on the margin of a tank and I hurried home for my fowling piece and batman, by now an expert at driving the wily fowl. We sat long behind a rock, deliberating on our plan, and regarding them hungrily through a telescope. Finally I crawled out on to a spit at the far side of the tank, within range of which I hoped the breeze would swing them. But when they took wing they did completely the wrong thing, climbing in the opposite direction. I was about to emerge from my position, when they turned and headed back towards me, and actually glided straight over my head, at an absurd height for my No. 6 shot, all I had. However to my astonishment my bird fell like a stone, probably one pellet in its head—a fearful fluke! But the local audience were suitably impressed, and I was delighted.

One more lot came on January 20, this time about seventy. A drive was arranged for them and this time they came low and two seemed already in the bag. But I had a dud cartridge in the right barrel, and so picked up one. It would happen with geese.

TACTICAL SCHOOL,
POONA,
April 14, 1943.

AUBREY BUXTON,
Capt.

VII.—WOODPECKERS FEEDING ON FRUIT.

As within the last week or two I have noticed both the West Himalayan Scaly-bellied Green Woodpecker (*Gecinus squamatus*), and the Black-naped Green Woodpecker (*Gecinus occipitalis*) eating berries on the trees here in Murree, I should be glad to know whether such a diet is usual with these birds.

ST. DENYS' SCHOOL,

MURREE,

December 12, 1942.

E. A. STORRS FOX,
Senior Chaplain, I.E.E. (Retd.)

[Woodpeckers are essentially insectivorous, a frugivorous diet is unusual.—Eds.]

VIII.—THE EGGS OF THE INDIAN BAY-BANDED CUCKOO (*PENTHOCERYX SONNERATII*).

On page 72 of 'Cuckoo Problems', Stuart Baker writes of the Bay-banded Cuckoo :—

'In the south of India Davidson, Bell and Stewart found them breeding fairly freely and took eggs in the nests of the Ioras, Red-whiskered Bulbuls, and small White-throated Babblers and saw these birds feeding young Cuckoos of this species. A few of the eggs I have seen from Travancore and the Western Ghats are certainly like some eggs of Red-whiskered Bulbuls, but none are in any way like those of Iora'.

On the 3rd August, 1941, I shot a female at Khandala (Western Ghats) with a shelled egg in the oviduct. The egg was damaged by the shot, but the remains have been preserved and the egg agrees with an Iora's—white background with sparse reddish-brown blotches and streaks heavier towards the thicker end. There were numerous enlarged ova together with this egg, and the bird (wing 128 mm.) was in heavy moult.

I am sending you the egg herewith and I shall be glad if you will forward it either to Mr. Stuart Baker or anybody else who is interested, when transport is safer.

C/O MESSRS. FAIZ & CO.,

75 ABDULREHMAN STREET, BOMBAY, 3.

February 12, 1943.

HUMAYUN ABDULALI.

IX.—GREEN PIGEONS IN A SWAMP.

One naturally associates green pigeons with banyan and similar fruiting trees, and it was therefore with some surprise that I put up a couple in a swamp near the village of Munderi up the Kakod backwater and some 7 miles direct north-east of Cannanore, on 17th March last. I was at the time not too hopefully looking for belated snipe and was working with a line of men through a swamp

covered with short reeds. Here and there a small hole had been excavated and the black saline earth thrown up round the edge. It was from one of these waterholes close in front of me that two green pigeons rose and flew back over the line, to perch on a cocoanut palm some 200 yards away. I could not be sure of the species but think they were Grey-fronted (*O. pomapadura*) and not the Southern Green (*C. phoenicopterus*).

Green pigeons so seldom visit the ground that this fact alone seems worth recording, but the incident raises another point of speculative interest. In 'Birds of Southern India' Col. Baker quotes Jerdon's remark that large numbers of Imperial Pigeons annually visit a salt swamp in the neighbourhood of Cannanore in the hot weather, and adds that though he lived some years at various times at Cannanore he had never seen or heard of this swamp nor could he get any information about it. I also have tried without success for many years to locate it. May it not be that the place where I found these green pigeons is the swamp to which Jerdon refers and that they visited it for the salt earth on the analogy of deer visiting salt licks? True they were green pigeons and not imperials, but if the latter have acquired this habit there seems no reason why the former also should not have it. That imperial pigeons eat earth at salt licks is mentioned on page 359 of Smythie's 'Birds of Burma'. I would add that in 25 years' experience of the country round Cannanore I have never seen a green pigeon before in the coastal area; but then I have never visited the swamps so late as mid-March.

BANGALORE,

April 10, 1943.

E. G. PHYTHIAN-ADAMS,

Major, I. A.

X.—SOME NOTES ON THE COMMON SANDGROUSE
(*PTEROCLIS EXUSTUS* TEMMINCK) IN KAIRA DISTRICT.

(With a plate)

I have kept notes on matters of shikar and natural history interest in Kaira District since 1930, and the following observations are based on these.

Pterocles exustus is the only sandgrouse found in Kaira District.

Distribution.—Found ordinarily only in small numbers along a relatively narrow belt bordering the western limits of the district. This belt widens both in its northern and southern extent; especially in the south adjoining Cambay State where the character of the country is more suitable; that is drier and barer sandy patches of land with scattered areas of cultivation near large barren plains. The common sandgrouse is a resident of the district, but the numbers to be found in any given year depend largely on the rainfall of the previous season. There seems to be a certain amount of local migration into and from the drier portions of Kathiawar, and the number breeding in the district varies considerably with the season. Ordinarily there must not be very many that nest in the district.

During the period under observation the rainfall was average or above average from 1930 to 1934, and during these years sandgrouse were seen only occasionally. From 1935 to July 1941, each succeeding year the rainfall was increasingly below average; 1939, 1940 and 1941 being extremely dry. In April 1940 the Vatrak river, just above its point of junction with the Sabarmati, was completely dry; the first time, according to the local villagers, that it had been so, since the famine year of 1900. At the same time many deep wells that had never been dry, went dry. It was during 1939, 1940 and up till the rains in 1941 that a marked increase in the numbers of sandgrouse in the district was noticed. During this period they were plentiful and some nests were found. In the following two years, 1941 and 1942 the rains were exceptionally heavy, above average for the district, and sandgrouse again scarce; and they are still so at the present (April 1943).

Nesting.—In the months of December, January and up till the end of February in 1940 and 1941 grouse were found in enormous flocks of several hundreds. Sometime during the last week of February these large flocks could no longer be found. Those then seen would be in scattered pairs or small flocks of six or eight here and there. The question arises whether this increase in the size of the flocks during December, January and February, is connected with pairing and breeding or whether it represents a preparation for a local migration of a certain number over into Kathiawar and the northern drier sections of the country.

The following are some extracts from my notes on nests and young:—

March 20, 1940. Saw, while riding in our car, about noon, a pair of common sandgrouse out in an open plain near Radhu. The hen was sitting on a newly scrapped out shallow depression, with the cock standing nearby. We drove up cautiously until we were within about eight feet of the pair without disturbing them. Watched them for some time from our seat in the car. (Unfortunately did not have the camera with us). It was only after my wife stepped out of the car that the pair flew off. The nest consisted of a simple depression in the ground, unlined, placed next to a lump of dried cowdung. There were no eggs.

March 27, 1940. Went back to photograph the sandgrouse and nest seen on March 20th near Radhu. Found the nest deserted. There were a few pieces of egg shell lying in and around the nest. Robbed?

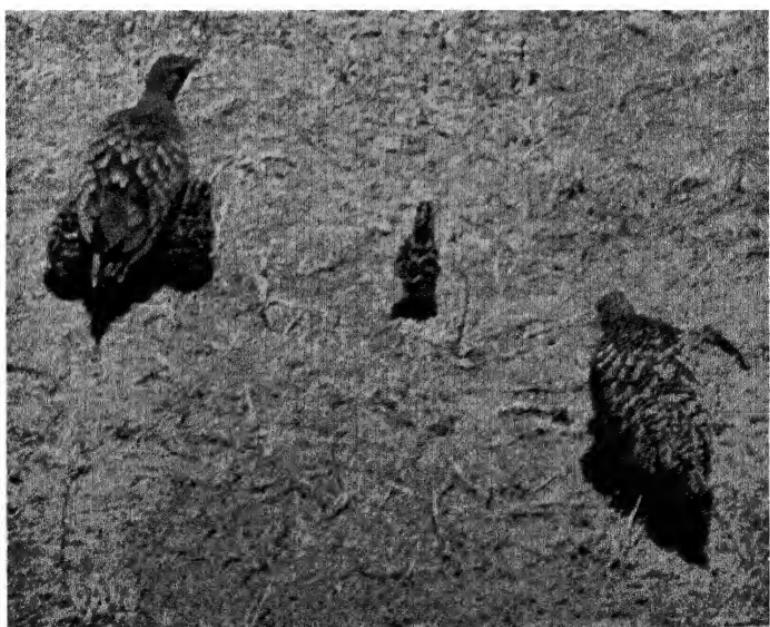
May 22, 1940. West of Traj; saw a pair of grouse with two recently fledged young dusting themselves in an ox cart road. The wings of the young were fully feathered and they could fly.

Feb. 12, 1941. West of Traj near the Vatrak river, saw several good-sized flocks of sandgrouse. Shot ten; of these, two of the hens were found to be with fully matured, and hard shelled oviduct eggs. The testes and ovaries of most of the others were enlarged.

Feb. 19, 1941. Wank. Saw several very large flocks of grouse coming to water between 10 o'clock and 11-30 in the morning. Shot 19 birds. All of the testes and ovaries of these were in an



1. Female with one chick under her wing and two standing in front of her.



2. Male, female and three chicks attempting to escape by slowly creeping away.

[Photos by Author.]

enlarged condition. One hen was found with a soft shelled oviduct egg.

April 30, 1941. Jakhara; while riding in our car, found a family of common sandgrouse, cock, hen and three chicks in down plumage. Was able to approach very closely to them by manoeuvring the car carefully. Got some good photographs with the birds in various positions. Whenever we would attempt to drive up towards them, in gradually narrowing circles, they would slowly creep off away from the car; always keeping their tails pointing towards us, changing their line of retreat with each change in the position of the car. They remained always in full view, and made no attempt to take advantage of any cover, though they several times passed clumps of dry grass and a small thorny bush. Throughout the manoeuvres the three chicks were constantly making an attempt to keep under the tails or next to the bodies of one of the parent birds. All of the birds seemed to suffer considerably from the heat while being shifted around in the bright afternoon sun; especially the chicks which could be seen breathing rapidly through open beaks. The chicks though able to walk freely, and appearing to be at least five or six days old, were not able to walk very steadily. Two or three times one or the other would upset in some small crack or depression; and they did not seem to be able to move very rapidly. (Partridge chicks of this age would have been very difficult to catch by hand). The parent birds fully appreciated the dangers their chicks were being exposed to from the air (hawks); they were constantly scanning the skies for a possible enemy. We did not get out of the car at any time. In all probability, the adult birds would have flown off to some nearby spot and the chicks would have perhaps 'frozen.' After taking several photographs from the car we left them undisturbed.

May 7, 1941. West of Kaira across the Vatrak river. Found a sandgrouse's nest out in an open patch between two uncultivated fields. The nest consisted of a small shallow depression, loosely lined with a few pieces of dried grass, and was placed between two small tufts of dry grass. It contained two hard-set eggs. The female bird was on the nest when discovered, but flew off immediately when approached.

(The technical details of the two photographs; enlargements of which are illustrated, are:—Taken at about 2 o'clock in the afternoon, very bright sunlight, with birds at a distance of about twelve feet from the camera. Camera Super Ikonta fitted with Zeiss Tessar F4.5, 10.5 cm. lens. Pictures taken on Panatomic-X film, at F16, 1/50 second. It should be noted that grouse are protectively coloured; and as they match their background so closely, are difficult to photograph satisfactorily, because of a lack of contrast between subject and background).

NADIAD,

HERSCHEL C. ALDRICH, M.D.

KAIRA DISTRICT,

April 13, 1943.

XI.—OCCURRENCE OF THE CLOSE-BARRED SAND-GROUSE (*PTEROCLIS LICHTENSTENII ARABICUS, NEUM.*) IN THE N.W.F.P.

I am also sending you the skin of a Close-barred Sandgrouse. This bird was shot near Alizai in the lower Kurram at an elevation of about 3,000 ft. above the sea level. It is described in Game Birds of India as being only found in Sind within Indian limits. Major Francis, Commandant of the Kurram Militia, who shot the bird, said that it was one of a small pack of 4 or 5 birds. They allowed the guns to approach quite close before getting up and even after being shot at came and settled quite close again after circling about a bit.

I shot a specimen of this bird two years ago near the village of Mullazai in the Tank sub-Division of the Dera Ismail Khan District. It was one of a party of 6 birds and they behaved in much the same manner as described above. Mr. Emerson shot one near Sarwekai in Waziristan, as far as I remember, at about the same time.

PARACHINAR,
KURRAM VALLEY, N.W.F.P.,
February 7, 1943.

J. O. S. DONALD,
Major.

XII.—LATE STAY OF SNIPE AND WEIGHT OF PINTAIL.

Yesterday i.e., 11th May 1943, close to Madura, I shot a snipe, a pintail, weight $5\frac{1}{2}$ ounces. He was with three Painters in rather dry stubble. This was a very late bird, and is possibly a record. He did not seem to be a wounded bird.

I shot a number of snipe here also on 1st May 1942.

MADURA.
May 12, 1943.

J. BECKETT, I.P.,
D.I.G. of Police, S.R.

(The heaviest pintail so far recorded is a bird weighing $12\frac{1}{2}$ tolas (about 7 oz.) shot by W. Gaye, at Secunderabad on the 6th January 1890. The average weight is about 4 oz.—EDS.)

XIII.—THE WHITE-FRONTED GOOSE (*ANSER ALBIFRONS SCOP.*) IN ASSAM.

I am writing to you to record the occurrence of the white Fronted Goose in Assam. As Stuart Baker refers to this goose as a rarity in Western India and quotes no authenticated instance of its being shot in Assam, the record may be of interest to members.

Some geese were reported to be down on the bheel near my bungalow (on the 7th of January) and on going out with the glasses I saw at once that the birds were neither grey lag nor bar-headed. It was the middle of the morning and three geese of a very dark

colour were standing out in the sunshine on the edge of a pool, in the middle of the open bheel. I could see no way of getting within shot and expected them to get up any moment and fly off to the Brahmapootra. However, I left my Labrador with a boy on the south side of the bheel to engage the attention of the geese, and making a wide détour crossed the bheel and got between the geese and the river. An exciting stalk then began; the going was very soft and entirely exposed and the geese, I could see, were very uneasy—one, as usual, the sentinel, head up, was staring in every direction; my only hope was a small herd of cattle grazing nearby, these I managed to work slowly towards the geese, creeping up when covered and crouching, still, when exposed. I had nothing but No. 8—so a pot shot was my only chance, eventually the cattle drifted apart and I had to take a long shot; he floundered about in the pool, but was retrieved in great triumph, one pellet had struck him in the head—his companions made off for the big river. He was in fine plumage and of course quite unmistakable, but the dark colouring was rather more dark ashey than dark brown as shown in Stuart Baker's plate.

I showed the goose to Mr. Buckingham Jones of Dibrugarh, who is a keen ornithologist, and was greatly interested.

My reference to the 'big river', the Bramapootra, reminds me of the derivation of the name given by the local 'uneducated' Assamese—who even today call it the Borompootar—in Assamese 'bor' is big and, of course, 'putra' spring or river. Sir Samuel Baker, in his books, always spells it (in italics) 'Borrompooter'—the name is understandable—the big river—the original inhabitants were animists and knew nothing of Brahma but it was easily corruptible into Brahma-putra, and, lately, German highly coloured prints used to be for sale in Dibrugarh for four annas depicting the 'Brahma'-putra gushing from the head of the God seated on a throne and surrounded by people somewhat resembling Hitler & Co.

MOTHOLA COMPANY LTD.,

DIBRUGARH, ASSAM,

January 26, 1943.

D. J. MONTAGNON.

XIV.—GYNANDROMORPHISM IN THE COMMON TEAL (*ANAS CRECCA* LINN.)

The Society recently received from Mr. H. W. Porter, Baluchistan, the head of a Common Teal shot at Quetta on 26th December 1942. The left side of the head shows the normal colouration and pattern of the adult male in summer and winter plumage; the right side is that of the adult female (or of the male in eclipse). A detailed description is given below:

Left side: As in adult male summer and winter plumage. Cheeks and lores chestnut. Thin cream-coloured lined from gape upwards along base of upper mandible over and under eye to nape, enclosing broad band of metallic green. This band still with slight admixture of a few unmoulted cinnamon-tipped brown feathers at its posterior end, near nape. Extreme point of chin (for 4 or 5 mm.) brown, the feathers tipped buff. Forehead, crown and nape

as in adult female, i.e. black-streaked brown, the feathers edged with buff on forehead and cinnamon-buff on crown and nape. Throat and foreneck parti-coloured medially, chestnut on the left side contiguous with the cheek, and whitish-buff on right. The division between the chestnut and whitish-buff is not clear-cut but some of the chestnut 'flows' into the white and vice versa.

Right side: As in adult female or in eclipse plumage of adult male. Cheek buffy-white. Upper throat and foreneck light buff more or less thickly spotted or streaked with blackish-brown. Indistinct blackish-brown streak from behind eye to nape. A tiny whitish patch under eye (also present under left eye). A single metallic green feather behind and slightly above eye the only indication of the broad metallic green band on the opposite side of the head.

Unfortunately merely the head, i.e., skull with mask (severed at the 'halal' cut) has been sent to us. The covering letter mentions that the rest of the plumage was female, but I feel that a critical examination would probably have shown the same bisexual characteristics as are present in the head. Also a morphological examination and dissection of the body would have proved of the greatest interest. The letter further remarks that the bird's right leg was missing below the tarsal joint. This may be accidental or congenital, and may or may not have to do with the otherwise abnormal condition.

The case is a highly interesting one and represents what I believe to be the first known occurrence in the Common Teal of that curious abnormality known as Gynandromorphism. Bird gynandromorphs or gynanders wear male plumage on one side of the body and female on the other; they are very rare and not much is known about them especially in life. Instances have been recorded in the Bullfinch (*Pyrrhula pyrrhula*), Chaffinch (*Fringilla coelebs*), Siskin (*Carduelis spinus*), the Pheasant (*Phasianus colchicus*) and in certain members of the families Ploccinae (Weaver Finches), Coerebidae (Sugarbirds of South and Central America), and Picidae (Woodpeckers).

In several examples that have been dissected a testis was found in the male half of the body (in most cases the right half) and an ovary in the female half. But sometimes this arrangement was reversed, as it presumably also was in the present case. Gynandromorphism is apparently less rare among insects, the commonest and most striking type being, as in birds, where the male and female halves of the body are sharply delimited lengthwise along the middle. In others a quarter of the body may be of one sex and three-quarters of the other. In some examples it is even less in extent, only patches of the characteristic form and colouration of one sex appearing on the body of the other. Natural gynandromorphism is apparently quite independent of the influence of sex hormones and is explained by an aberration in the chromosome distribution in the development of the gametes. And here a little digression is perhaps desirable.

Sex hormone is a chemical secretion of the gonads (testes in male; ovaries in female) which pours into the blood-stream in the same way as do hormones from the other ductless glands situated in various parts of the body, collectively known as the endocrine system. It circulates with the blood and is known to control the secondary sexual characters such as the beard in Man, antlers in most deer, and the plumage in sexually dimorphic birds. But it

can obviously influence an organism only as a *whole*, and therefore the possession by a gynander of both male and female sex glands could not by itself account for the clear-cut bipartite effect, for instance as seen in the plumage of bird gynanders.

'Cock-feathered' female pheasants are well known. It is also known that this peculiar condition is brought about by damage to the bird's ovary—atrophy, either through old age or disease. It has been proved experimentally that female feathering in the domestic hen (and presumably also in its wild relations) is due entirely to the influence of the female sex hormone discharged into the blood by the ovary. If the ovary of a domestic hen is removed—an operation known as ovariectomy—it will assume cock plumage at the next moult including the long tail. This is because the influence of the female sex hormone, on which hen feathering is dependent, has been removed. If a cock's testes are removed—by castration—although certain other changes such as shrinking in size of the comb will soon be observed, yet its plumage at the next moult will grow again unaltered in appearance. This proves that 'cock feathering' is really speaking the 'Neutral' phase of plumage and not dependent upon the male sex hormone. Thus by castrating a cock and ovariectomising a hen it is possible to produce 'neutral' birds that look closely alike. This neutral bird, however, can be further changed to male or female by engrafting it with the relative male or female gonads.

With the exception of some raptorial birds chiefly of the genera *Falco*, *Accipiter* and *Circus* and certain other birds which possess paired functional ovaries, the general rule is that only the left ovary is functional while the right is suppressed and remains vestigial. Experiments show that if the left ovary of a bird is removed the right one, till now dormant, develops. But the curious point is that it develops not into an ovary to replace the missing one as one would expect, but actually into a male testis! Thus a hen in which the left ovary has been removed soon develops into a cock. The sex hormone released by the newly formed testis brings about, in the erstwhile hen, all the characteristics of appearance and behaviour of the cock even to the extent of attempting to mate with hens. Effective mating is however rendered impossible owing to anatomical disabilities, but an exceptional case is on record where such a sexually reversed bird, a good egg layer up till 3 years old began to crow at 3½, and took on most of the male characters. At the age of 4½ on being mated to a virgin hen it became the father of 2 chicks! It will thus be seen that it is actually possible to produce a cock (in this case even a perfectly functional one) by removing the left ovary of a hen!

As distinct from the *Natural* (due to chromosome derangement), *Artificial* gynanders have been produced in the laboratory thus: A cock was plucked of its feathers on one side. It was castrated and implanted with an ovary. Under the influence of the female sex hormone, the plucked side soon developed female feathering so that until the next moult that bird presented the characteristic bipartite appearance of a natural gynander. At the next moult,

however, the male half of the feathering disappeared and was replaced by female plumage all over.

33, PALI HILL,
BANDRA, BOMBAY.

SÁLIM ALI.

XV.—OCCURRENCE OF COMB DUCK (*SARKIDIORNIS MELANOTUS* PENN.) IN MYSORE.

With reference to Mr. R. F. Stoney's note xiii on p. 525 of vol. xlivi, I have to record shooting a Comb duck (female) about 50 miles west of Bangalore on 14-1-43—the bird was solitary. This is the first of the species shot by me in S. India though I had definitely seen it once previously near Gundlupet, 40 miles south of Mysore City.

BANGALORE,
January 18, 1943.

E. G. PHYTHIAN-ADAMS.
Major.
I.A., F.Z.S.

XVI.—RED CRESTED POCHARD (*NETTA RUFINA* PALLAS) IN MADRAS PRESIDENCY.

As reports of this duck in the Province appear to be scanty, it may be of interest to record that I shot a male from a flock of about 30 on a tank near Cumbum in the Kurnool District on 11-12-1942.

BANGALORE,
January 18, 1943.

E. G. PHYTHIAN-ADAMS.
Major.
I.A., F.Z.S.

XVII.—NOTES ON THE VIVIPARITY OF THE COMMON INDIAN SKINK [*MABUYA CARINATA* (SCHNEIDER)].

A specimen of the common Indian skink, *Mabuya carinata* (Schneider) was collected from the suburbs of Calcutta on March 11, 1943, for the study of its protozoal contents and helminths by my colleagues Messrs. M. M. Chakravarti and G. K. Chakravarti. It was a gravid female and contained embryos in a fairly well-developed condition. It was handed over to me in a partially dissected condition for the collection and preservation of the embryos, and my thanks are due to my colleagues on this account. In view of the dubious viviparity of this species (Smith, '35, p. 268) it seems desirable to record the following observations.

The specimen was fairly large, measuring 124 mm. from snout to vent, the tail being 149 mm. The eggs with ripe embryos were arranged in fours, one after the other in a series, in each uterus. An ovary with immature ova in various stages of development was

found to be located on the left side of the vertebral column very near the left oviducal opening, there being no trace of any other ovary on the right side, which might have been lost while the alimentary tract was removed. The eggs *in situ* appeared to be broadly oval and were about the same size. Unfortunately they had not been measured before the embryos were taken out, but from an ocular examination they were estimated to be 15 by 10 mm. on an average. Although each embryo was in a fairly advanced stage and had pentadactyle limbs well-developed, the egg itself contained much yolk. The outer envelope covering the eggs was thin, colourless and transparent, and the vascular allantoic sac was clearly noticed through it. From this it might be assumed that a calcareous shell had not been so far deposited on the egg. The translucent uterine wall which was very much thinned out presumably owing to the lodging of the developing embryos enabled me to notice also the movement of the embryos as well as the allantoic circulation.

It should be noted that I did not much care to determine how the eggs were held in the uteri, especially the mode of their attachment to the wall of the uterus, as recorded in certain lizards giving some hints of placental connection (Kerr, '19, p. 483).

The embryos were carefully removed from the eggs and fixed in the aqueous Bouin's fluid. It was observed that the embryo within the egg lay snugly curved upon itself, while the long tail was coiled a few turns and hugged between the limbs. All the embryos appeared to be more or less in the same stage of development. On the following day, when they were measured, the length from snout to vent ranged from 22 to 23 mm., with 22.5 mm. as the average, and the length of the tail, between 23.6 to 25.8 mm., with 24.7 mm. as the average.

Although the embryos look like veritable miniature skinks, their morphological characters differ somewhat from those of the adult pattern. The head was proportionately large as is usual in all embryos. The brain was clearly visible through the almost transparent membranous skull. The head and chin shields, so characteristic of the adult, were not yet developed, while a uniform non-overlapping squamation covered the rest of the body, viz., throat, trunk with limbs and tail. The eyes were prominently developed, and the lower eye-lids without any scales. It is interesting to note that the parietal organ which is so characteristic of almost all lizards (Sedgwick, '05, p. 344), was seen very clearly under the binocular microscope, in the form of a dark-ringed fleck on the middle of the head of the embryos. This parietal fleck was, however, not evident in the adult female specimen from which the embryos were removed. The ear opening covered by the tympanum was not yet deeply sunk. The limbs were well-developed, as noted before, with fully-formed digits. The fingers, and especially the toes, however, had not attained the characteristic pattern and relative proportions of the adult. Pigmentation did not occur in any part of the embryo. No 'egg-tooth', such as occurs in very many lizard embryos at the extreme tip of the snout, was observed. From the data at hand it cannot be decided whether

M. carinata produces young alive or lays eggs containing ripe embryos only to be hatched soon after.

With regard to Gadow's ('01, p. 560) sweeping statement: 'all the Scincidae seem to be viviparous', Malcolm Smith ('35, p. 256) expresses an element of doubt, since he has recorded more oviparous forms than viviparous ones. He holds that viviparity is possibly true of the majority of the Australian skinks, but not of the Oriental forms. He states further that so far as is known of the Indian genera of Scincidae, all the species of *Tropidophorus* are viviparous, and of the rest only four species belonging to three genera, viz., *Mabuya aurata*, *M. m. multifasciata*, *Lygosoma i. indicum* and *Leioploisma himalayanum* are recorded to be viviparous. Closely related species and even genera frequently adopt either method of breeding, and from this point of view the genus *Mabuya* becomes extremely interesting in that the 'closely allied species may produce young by either method, for example, *Mabuya carinata* and *M. multifasciata* or *M. dissimilis* and *M. aurata*' (Smith, '35, p. 6). Boulenger (1890, p. 190), however, under the species *Mabuya macularia*, notes, 'this species is stated by Theobald to be oviparous, whilst its close ally *M. carinata* is, like most Scincoids, viviparous.' Perhaps to this statement Malcolm Smith (*loc. cit.*, p. 268) has taken exception, and reiterates in reference to the species *M. carinata* particularly, 'it is usually stated that this Skink is viviparous, but such is not the case. A female kept by Father Dreckmann in captivity laid 23 eggs; from another female he removed 22 eggs. All are of about the same size, approximately 13 by 8 mm.; none of those examined shows any trace of embryo. Both clutches are now in the British Museum.' From the above statement it is quite apparent that Malcolm Smith lays considerable emphasis on the oviparity of *M. carinata*. But the observations recorded by me above on *M. carinata* differ from those of Father Dreckmann. It appears to me, however, that the eggs obtained by Father Dreckmann were in all probability either infertile or in a very early stage of development.

Now the point is whether *M. carinata* can be called viviparous or not. It may be pointed out that Malcolm Smith ('35, p. 263 and p. 269) notes that *M. aurata* contains eight almost fully developed embryos, while *M. m. multifasciata* produces five to seven young ones. Both the species, in his sense of the terminology used, are viviparous. From this emerges the view that a female specimen containing embryos in the uterus may as well be described as viviparous. It may also be noted in this connection that Gadow ('01, p. 499) in general consideration of the Saurian eggs states, 'many Lizards do not lay their eggs until they contain ripe embryos, which burst the shell shortly after deposition. Some, for instance *Lacerta vivipara*, *Anguis fragilis*, and *Chamaeleo pumilus*, are practically viviparous.' Further, Graham Kerr ('19, pp. 482-83) is of the opinion that there are three steps in the evolution of viviparity in reptiles. In the first type are included those forms (*Anguis*, *Vipera*, *Coronella*) in which the egg is merely retained within the uterus, the egg-envelope persists without having any intimate relations developed between the embryo and the maternal tissues.

Note should be made of the fact that an intra-uterine development of the ovum into an embryo generally takes place before the egg is deposited. As *M. carinata* seems to belong to this type, I do not refer to the other two types described by Graham Kerr. From all these considerations, *M. carinata* is, to all intents and purposes, a viviparous skink, and not an oviparous one as contended by Malcolm Smith. If *M. carinata* lays eggs at all, such as those with embryos as described above, it should rightly be described as ovo-viviparous, and strongly do I suspect that many of the skinks would turn out to be ovo-viviparous in which the hard calcareous shell has been dispensed with. As far back as 1890, Boulenger noted, 'they (Scincoids) are, as far as we know, ovo-viviparous, with the exception of *Mabuya macularia*, which, according to Theobald, is oviparous' (p. 180). Annandale ('10, p. 201) and Okada ('35, p. 56) incidentally lend support to the view that most skinks are ovoviviparous.

A further coincidence of fact that may be noted here is that *M. aurata* and *M. carinata* both contain eight well-formed embryos, while *M. m. multifasciata*, which is a close ally of *carinata*, produces five to seven young ones. But the number of eggs (23 and 22) laid by or removed from *M. carinata* as given by Father Dreckmann (Smith, '35, p. 268) seems surprisingly larger and is no less puzzling. This, therefore, requires further confirmation in the light of present observation as well as from the fact that none of the skinks, especially *Mabuya*, has so far been credited with laying eggs or producing young ones more than nine in number.

McCann ('40) who has recently given elaborate accounts of breeding habits of many Indian lizards, records some brief observations on the two common species, *M. carinata* and *M. macularia*, but he has not noted anything about the breeding habits of the former except that the young ones are numerous during the months of June and July. The presence of young would naturally indicate that hatching must have occurred recently. However, he has given a photograph of the genital organs of a female *M. carinata* which clearly demonstrates that both the ovaries contain immature ova, and that they are situated at different levels, the right one being located slightly anterior to the left. It cannot be made out from that photograph, nor from the text, whether the specimen is a recently parturiated female or not.

Blanford notes (*vide*, Smith, '35, p. 268) that the breeding season of *M. carinata* in the Godavari district is during March, and it is true of the specimen, though single, obtained from Calcutta in March.

JNANENDRA LAL BHADURI.

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35, BALLYGUNGE CIRCULAR ROAD,

BALLYGUNGE, CALCUTTA.

March 29, 1943.

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Since the above article was written and accepted for publication in this *Journal* on April 6, 1943, I have come across a short note on the same subject [An instance of 'viviparity' in *Mabuya carinata* (Schneid.)] written by Mr. R. V. Seshaiya and published in 1938 (*J.B.N.H.S.*, 40, p. 132, 1938). I regret very much to have missed referring to this article. As my observations are considerably different from his brief account, although the conclusion is somewhat alike, I do not like to alter the text of my article. A brief comment may, however, be made here. Mr. Seshaiya did not record, *inter alia*, the number of eggs that were actually present in the uteri and the time of breeding, nor did he add a description of the embryos except that they superficially resembled a 3-day-old chick embryo. It appears that the embryos obtained by him were certainly in much earlier stages of development than those recorded by me above.

ZOOLOGICAL DEPT., UNIVERSITY OF CALCUTTA,
35, BALLYGUNGE CIRCULAR ROAD,
CALCUTTA,
April 28, 1943.

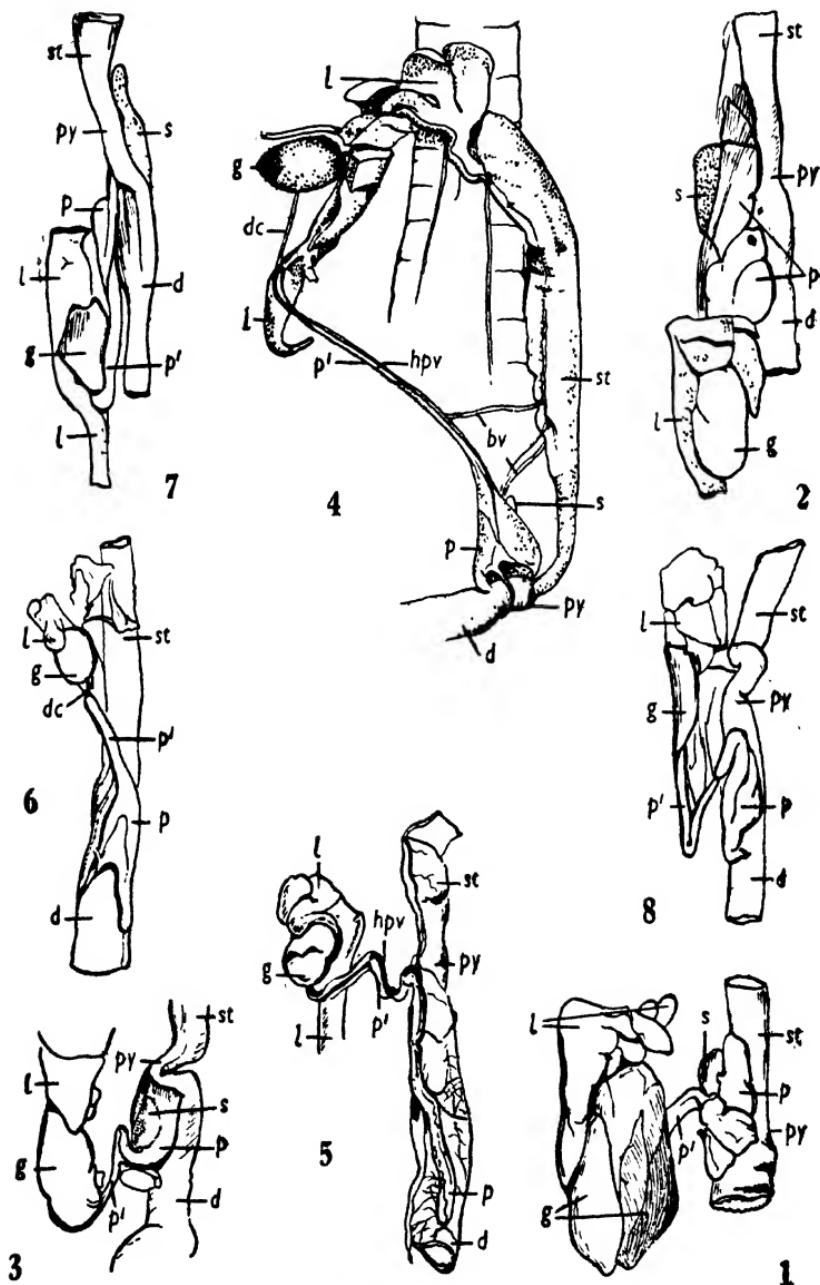
J. L. B.

XVIII.—THE ANATOMY OF THE DUODENAL REGION OF SOME GENERA OF APODA (AMPHIBIA).

(*With two plates*)

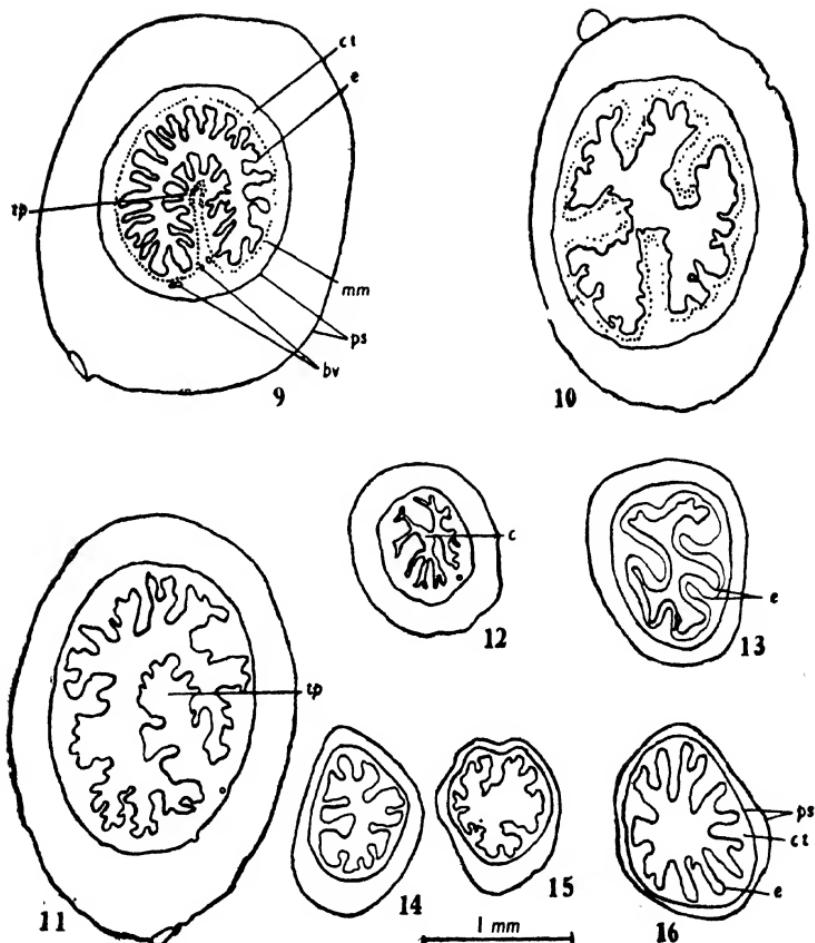
A comparative study of the duodenal region of some apodan genera was made to note the opening of the hepatic and pancreatic ducts.

In *Anura*, it is common knowledge that the hepatic ducts arising from the liver lobes unite to form a common hepatic duct with which one of the cystic ducts coming from the gall bladder merges to form the ductus choledocus. The other cystic duct opens into the common hepatic duct entering the pancreas. Entering into the choledocal duct, there is a duct (as shown by Wiedersheim) from



L. S. Ramaswami—Anatomy of duodenal region of Apoda.

(For explanation see end of note).



L. S. Ramaswami—Anatomy of duodenal region of Apoda.

(For explanation see end of note).

the pancreas formed by the union of small ductules. O'Donoghue (1925, p. 47) described many small pancreatic ductules opening into the hepatic duct. The choledocal duct enters the duodenum. There are no separate pancreatic ducts, therefore, opening into the intestine.

On the other hand, in *Urodela*, the pancreas throws its secretion into the duodenum by two ducts; of these the anterior opens behind the pylorus and the posterior along with the hepatic duct (Noble, 1931, p. 205). It is noted that the duct corresponding to the anterior one of the *Urodela* disappears in *Anura* (Göppert, 1891); the other opens into the ductus choledocus.

I have examined the duodenal region of the following examples of *Apoda* both by dissection and by sectioning:—

Ichthyophis glutinosus (Linné); *I. monochrous* (Bleek.); *Gegenophis carnosus* (Beddome); *Ureotyphlus narayani* Seshachar; *Dermophis gregorii* Blgr.; *Boulengerula boulengeri* Torn.; *Herpele ochrocephala* (Cope) and *Scolecomorphus uluguruensis* Barb & Lov.

The gall bladder (text-figs. 1-8, g.) situated at the posterior end of the lobulated liver (l.) can be clearly seen in a ventral dissection. The cystic duct arising from the dorsal aspect of it joins the large hepatic duct coming from the liver. Opening into the latter are a few hepatic ductules. The ductus choledocus (text-figs. 4, 6, dc.) passes through the tissue of the pancreas p¹, p.) (the anterior limb of which is situated near the liver) closely associated with the hepatic portal vein (h_{pv}).

The larger part of the pancreas (text-figs. 1-8, p.) is associated with the duodenal part (d.) of the intestine and it is in this region, i.e. posterior to the pylorus (py.) that the openings of the common hepatic and pancreatic ducts are noticed. Tracing sections from the pyloric end, in all the examples studied, a large duct arising from the pancreas opens into the intestine, which therefore, would correspond with the anterior duct of *Urodela*. In her figure 76 (Pl. xxii) Francis (1934) described the anterior as dorsal duct in *Salamandra*. However, in two examples of *Apoda* studied by me (*Scolecomorphus*, *Ureotyphlus*) another smaller pancreatic duct gains entry into the intestine (which may therefore, be called second anterior) before the choledocal duct opens into the gut. Posterior to this choledocal opening, the intestine receives the second or posterior pancreatic duct. In *Dermophis* the posterior pancreatic and choledocal ducts unite before opening. In *Salamandra* also, Francis (1934) described the posterior duct opening into the duodenum by two ductules, one anterior and the other posterior to the common bile duct.

The difference between the anuran and apodan gall bladder is at once apparent. While in the former there is a cystic duct to lead bile into gall bladder from which duct there is another to throw the juice into the choledocal duct, in *Apoda*, on the other hand, the gall bladder is merely an enlargement of the hepatic duct corresponding to the first type shown by Kingsley (1926, p. 259, fig. 284).

The presence of double independent pancreatic ducts opening into duodenum would naturally relate the *Apoda* more with *Urodela* than with *Anura*.

A word or two about the pylorus may not be out of place here. The series of figures drawn of the pylorus (text-figs. 9-16) of the genera investigated, it is noticed that the pyloric sphinctre is poor in *Dermophis* (text-fig. 15) and *Herpele* (text-fig. 16), fairly well developed in *Boulengerula* (text-fig. 14) and very well developed in *Ureotyphlus* (text-fig. 12), *Gegenophis* (text-fig. 11), *Ichthyophis monochrous* (text-fig. 9), *I. glutinosus* (text-fig. 10) and *Scolecomorphus* (text-fig. 13). In *Ureotyphlus*, *Gegenophis*, *Ichthyophis* and *Scolecomorphus* where the histology of the pyloric epithelium could be studied with certainty, it is noticed that the gastric epithelium also lines the pylorus; however, glands are absent. In *Ureotyphlus* (text-fig. 12) the cavity is considerably reduced on account of the villi-like projections; in *I. monochrous* (text-fig. 9: not *glutinosus*) and *Gegenophis* (text-fig. 11) there is a 'typhlosole'-like (tp.) projection which starts from the post gastric region and ends in the pylorus. This projection, however, is not continued into the intestine.

SUMMARY.

The duodenal region of the apodan genera examined reveals an interesting feature. There are two pancreatic ducts; one opening into the intestine in front of the choledocal duct and the other along with it or posterior to it. In this respect, the Apoda resemble the Urodela where also two ducts are described; in Anura there is only one duct corresponding to the posterior of Urodela.

I wish to express my thanks to Prof. A. Subba Rau for helpful criticism.

INTERMEDIATE COLLEGE,
MYSORE,
March 10, 1943.

L. S. RAMASWAMI,
Dept. of Zoology, University of Mysore.

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EXPLANATION OF PLATES.

Plate I.

Ventral view of the slightly distended duodenal region of:
 text-fig. 1. *Ichthyophis monochrous* (Bleek.).
 2. *I. glutinosus* (Linné).
 3. *Ureotyphlus narayani* Seshachar.
 4. *Gegenophis carnosus* (Beddome).
 5. *Scolecomorphus uluguruensis* Barb & Lov.
 6. *Dermophis gregorii* Blgr.
 7. *Herpele ochrocephala* (Cope).
 8. *Boulengerula boulengeri* Torn. [all $\times 6$]

bv. blood vessel; *d.* duodenum; *dc.* ductus choledocus; *g.* gall bladder; *hpv.* hepatic portal vein; *l.* liver lobe; *p.* pancreas; *p'.* the thinner anterior portion of pancreas reaching liver: *py.* pylorus; *s.* spleen; *st.* stomach.

Plate II.

Transverse section in the region of the pylorus of :
text-fig. 9. *Ichthyophis monochrous* (Bleek.).

10. *I. glutinosus* (Linne).
11. *Gegenophis carnosus* (Beddome).
12. *Urotryphius narayani* Seshachar.
13. *Scolecomorphus uluguruensis* Barb & Lov.
14. *Boulengerula boulengeri* Torn.
15. *Dermophis gregorii* Blgr.
16. *Herpele ochrocephala* (Cope).

bv. blood vessel; *c.* cavity of the pylorus; *ct.* connective tissue layer; *e.* epithelium; *mm.* muscularis mucosa; *ps.* pyloric sphincter; *tp.* 'typhlosole'-like projection.

XIX.—A NOTE ON FISH MORTALITY IN THE SOHAN RIVER.

(Comment on *Miscellaneous Note*, No. XX, Vol. xxxiii, No. 3, p. 534).

As fishes are very sensitive to free and albuminoid ammonia, acids and alkalis and deficiency in dissolved oxygen in water, any abnormalities of these constituents are likely to prove dangerous. It appears from the report that the water is 'strongly acidic' due to 'free acids' and as such it is harmful to fish life. The pH value of water going below 6.7 (7 being the neutral point) is not conducive to their health. The report does not state what acids were found in the water and how much, but since it is noted as 'strongly acidic' it implies that the pH value must be very much less than 6.7 and is therefore dangerous to fish life.

I would advise that samples of water collected from three different places, namely, (1) one from the place where the Leh river joins the Sohan, (2) one from the Leh river before it falls to Sohan, and (3) one from the place about $\frac{1}{4}$ mile up the Sohan river, be examined. A comparative statement showing the amounts of (1) dissolved oxygen, (2) oxygen absorbed by organic matters (Tidy's process), (3) free and albuminoid ammonia, (4) nature of the free acids if any and (5) the pH value of the water (simple colorimetric method will do) along with the usual details of ordinary analysis is very helpful for studying the condition. It is not possible to give a definite opinion about the nature of water which is likely to endanger fish life, unless the above data are available.

CALCUTTA,

K. N. BAGCHI, D.Sc.,

February 19, 1943. Chemical Examiner to the Govt. of Bengal.

XX.—*PAPILIO ARCTURUS* IN THE HIMALAYAS.

As is well known to Himalayan Lepidopterists there are five beautiful species of swallowtails belonging to the blue- and green-spotted group of which *Papilio paris* may perhaps be regarded as the most typical example at the same time as possessing the most

extensive geographical distribution of them all not only in the Himalaya but eastward throughout southern China. While, however, *Papilio ganesa* is apparently confined to the south-eastern portion of the chain it is represented west of Nepal by the closely allied *Papilio polyctor*, which in the neighbourhood of Simla is well known to European collectors by the name of the monal. The beautiful *Papilio krishna* is, I believe confined exclusively to the south-eastern Himalaya of Nepal, Sikkim and Bhutan. Of the preceding, the first three are strictly sub-tropical being confined to the potter valleys below 3000 feet although individuals are occasionally carried up by ascending currents of warm air, 1000 or even 2000 feet above their usual habitat. On the other hand, the last-named species is a denizen of the cold-temperate zone besides that of the warm-temperate occurring thus within the latter climatical belt at about 3000 feet and from thence ascending up to 9000 feet or so. The fifth species, the special subject of this memoir, *Papilio arcturus* is apparently the only exclusively cold-temperate species of the group of what I denominate the 'Peacock Swallowtails', its habitat comprising the cold-temperate forests at an altitude of between 6000 and 9000 feet. This beautiful species is fairly plentiful in the south-eastern Himalaya, more especially on the so called 'Outer ranges' though I have also met with it in the interior of Sikkim on slopes in close contiguity to the high snow peaks at about 8000 feet. In the immediate neighbourhood of Darjeeling it is of frequent occurrence, where on Observatory Hill at an altitude of nearly 7000 feet I have seen it on the wing during every month from the middle of April to the middle of November, though it is most plentiful in June and July. This species is somewhat seasonally dimorphic and possesses apparently as many as five broods in the course of the year if my observations are correct, the first appearing in the *imago* stage in April, the second in May and June, the third throughout July and August, the fourth in September and October and the fifth during November. As I have not reared it from the caterpillar I do not know however in what stage of its metamorphosis it hibernates or passes through the winter. Although the winters are comparatively mild at Darjeeling, snow being only of very occasional occurrence and frosts, with the exception of hoar frosts, practically absent in most seasons, it would nevertheless be too cold for the *larva* to continue to feed throughout the winter solstice. Accordingly I am under the impression that it is the chrysalis which hibernates. If this is so the perfect insects which appear in April may be representatives of some which did not emerge in the winged state the previous November in consequence of unfavourable metrological conditions; on the other hand they may be the entire product of the fifth brood. Only those entomologists continuously residing on the spot could elucidate this enigma with any degree of certitude however, I presume with regard to their seasonal dimorphism (or trimorphism): the first and fifth broods are closely alike in their small size and the colour of the powdered scales on their wings which are predominantly of a golden bronze instead of the bluish-green of the later broods. The largest specimens by far, besides being the most brilliantly coloured, belong exclusively to the brood which makes its

appearance immediately subsequent to the summer solstice and continues on the wing throughout July and August and occurs accordingly at the period of the greatest S.-W. Monsoon deluge, at sunny intervals during which specimens may be always seen on the wing. The second and fourth broods which appear respectively throughout May and June and September into October are about midway in size with regard to the expanse of their wings to the extremes represented by the first and fifth broods in comparison with the third or mid-summer form of the perfect insect. During my stay at Darjeeling I obtained a very fine series of this beautiful species, illustrative of all the different broods, which was much admired by my friend Dr. Alfred Russell Wallace when he came to see my collection of Himalayan Butterflies many years ago.

PLYMOUTH,

WILLIAM HARCOURT-BATH.

February 6, 1943.

XXI.—CONTROL OF *AEDES EGYPTUS (STEGOMYIA FASCIATA)* OR TIGER MOSQUITO (THE CARRIER OF YELLOW FEVER) IN THE BOMBAY HARBOUR BY A PATENT MOSQUITO-PROOF CAP AND TAP.

Brig.-General Covell, I.M.S., Director, Malaria Institute of India commenting on the discussion on his report on Malaria in Bombay remarked that Bombay was known as the worst Port for mosquitoes in the East as instanced by the repeated complaints made by Ships officers visiting the Port. He simultaneously urged for devising means to control the unlimited breeding of *Aedes egyptus*, the cause of this prevalence of mosquito in the country craft in the Harbour and Docks of Bombay. Since then much water has flown under the bridge. In 1935 soon after assuming the charge of Malaria Preventive Measures in the Port Trust Estates, Docks and Bunders as its Administrative Medical Officer, a preliminary survey of country craft made by me revealed that out of 898 country craft examined, 458 or more than half the number were found breeding *Stegomyia fasciata* giving a ratio of about 51% or that every alternate native craft was breeding the pest. This mosquito breeds profusely in one or more open fresh water receptacles or barrels which are round or oblong, square and box-shaped liberating thousands of adults. Most of these barrels are open or barely covered with a piece of cloth or plank, water being taken in Bombay or along other ports of call in all sorts of conditions. This water when examined revealed not only mosquitoes, but dirt and debris of all kinds including droppings of rats, cockroaches, fibre or coal particles and was drawn by hand for drinking with the risk of conveying diarrhoea, dysentery and cholera germs. As the Bombay Port Trust did not have compulsory powers for examination of the craft at the time, it was decided to continue to carry out the surveys further by examination and emptying out water when necessary by a notice freely circulated urging gentle persuasion and education of the tindal or master of the craft. Many refused at first the voluntary request, but with a full year of

working with constant examinations and emptying out, 19453 country craft or vessels were examined in 1935-36 showing a reduction in breeding of 28.7%, in 5688 of the craft so examined when 5551 were persuaded to empty out the infested waters. Fresh water was allowed free from the Docks and Bunders in its place. Progress was made in 1936-37 with the same voluntary working when with the repeated inspections and emptying out, breeding further diminished to 19.3% as seen from figures given below. Improvement continued during the next year to 14.4% in 1937-38, the peak of period of examination of 30602 vessels when the numbers breeding fell to 4412 from 5551 in 1935-36 all complying with the procedure.

This working was detailed and published by me in three preliminary papers (Nos. 3, 4, 5) on the subject as referred to at the end of the article. The following figures give the actual working for the last 7 years:—

COUNTRY CRAFT.

<i>Years.</i>	<i>Examined.</i>	<i>Breeding.</i>	<i>Emptied out.</i>	<i>Percentage.</i>
1935.	898	458	358	51 %
1935-36.	19,453	5,608	5,551	28.7 %
1936-37.	22,789	4,338	4,335	19.3 %
1937-38.	30,602	4,412	4,412	14.4 %
1938-39.	27,301	3,612	3,612	13.2 %
1939-40.	34,338	2,768	2,768	8.06 %
1940-41.	26,195	1,639	1,639	6.2 %
1941-42.	25,200	1,466	1,466	5.8 %

At the end of 1936, as a result of the voluntary work having been carried out successfully, the Government of Bombay gave the Port Trust compulsory powers by a rule under the Ports Act 1908 section 6 (1) (p) to inspect and deal with country craft so infested within the precincts of the Port and the Trustees appointed their Administrative Medical Officer to carry out the work. Soon after in 1937 a further step was taken in fitting of a mosquito-proof cap with a wooden cork or plug for the open entrances with provision of a separate tap to draw off water. This was at first fitted to our own craft for effectively stopping breeding of *Stegomyia* in the barrels and was adopted as a standard for others to follow when found successful.

The cap is made of a strong perforated zinc plate with a mesh of $1/16$ in. in the shape of an inverted square boater fixed to the opening by screws. It is closed by a wooden cork or plug with a nob on top to which a small chain is attached anchoring it to a side of the opening (for full details with sketches and plans see paper 6). Thus the cap serves as a filter to all impurities and does not allow the imago or full-grown insect to escape even if water be laden with eggs of the mosquito. The cork keeps out cotton, cocoanut and other fibres, dust or coal particles entering it, thus keeping the water sweet and clear and further eliminating risk of contamination by hands dipped into the water. A brass cock or tap is fitted at a suitable distance from the bottom of the cask or barrel to draw water which is used mainly for drinking purposes. The capacity of such a barrel is often some 10-25 gallons for a

small and for a big square wooden cistern about 400 or more gallons each carried by country craft coming from long distances like Karachi, Cutch, Kathiawar, Cochin, Arabia, Africa, etc. The whole Western Coast line or littoral of India is infested with this mosquito as shown by craft coming from estuaries and even rivers up the coast such as from Surat, Navsari, Goa and Cochin etc. where water is often taken from wells or step wells.

The gradual diminution in the findings of breeding in subsequent years is an event of evolutionary reduction of the Stegomyia Index due to constant inspections and emptying out of such infested craft, The device if and when adopted to those coming from other ports will still reduce the Stegomyia Index to the normal safe one of 2%.

I am glad to report that so far the caps and taps fitted by kind permission of the Trustees at their Workshops have withstood more than 4 years of hard wear and tear and none of the barrels so fitted have shown any breeding. The advantages of this pucca device are evident in the long service and efficacy of its working the benefits of which are now being appreciated by all owners who often request and send new barrels to be fitted up at our Workshops. Further no drastic action under the powers has been necessitated nor any obstruction offered by the owners or servants plying the boats. It has freed them of the annoying attention of their own mosquitoes bred in man-made receptacles as said by Mhatre and Covell in their reports.

To deal with this nuisance in the Port, for some two decades, both the Bombay Municipality and Port Trust have approached the Government from time to time, but no decision was arrived at in the absence of a suitable working scheme and when this was attained on sound and practical lines it was easy for Government to give the long-needed powers to the Port Trust to enforce control over the infested craft entering their precincts. Thus in this instance instead of Legislature enforcing a certain procedure or custom, the correct procedure has justified the necessary enactment or rule as a beneficial one. This provision of cap and tap and constant inspections are the full answer to Brig. Covell's quest in 1928 to devise a way to check this nuisance of constant annoyance and danger to the public and the sea faring or Mercantile Community visiting the Harbour. In fact all of Col. Covell's recommendations have been practically carried out during my regime including Roof-gutters work, a pioneer work of its kind in Indian Ports with mosquito-proofing of all Port Trust tanks both on ground and overhead at considerable expense. Lastly larvicidal Gambusia fish has been introduced into sweet water static and open tanks. That instead of Bombay being one of the Worst Ports in the East for Mosquitoes, I have tried to make it one of the Safest Ports in the East. For this I have to thank all the Chairmen and Trustees of the Port with the present Chairman, Sir B. Rama Rao, I.C.S., for the kind help and the latter for permission to publish this paper.

BOMBAY,
February 13, 1943.

F. D. BANA,
M.B., M.R.C.S., D.P.H., D.T.M. & H., I.P.
Administrative Medical Officer,
Bombay Port Trust.

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XXII.—OBSERVATIONS ON A FEW CASES OF LARVAL ECDYSIS OF THE INDIAN GLOW-WORM, *LAMPYRPHORUS TENEBROSUS* WLK.

1. *A complete moult of the larva.*

On 12th March '42, a completely moulted skin was found along with a larva kept in a dish and the newly moulted larva was bright and oily with the marginal areas of the dorsal plates more brownish than yellowish. From an examination of the moult it was discovered that the thin cuticle lining the photogenic organ also was cast and the linings of the tracheal tubes were as usual left attached to the moult here and there. The linings of the mouth-parts and even the eye were cast out. The whole moult was complete excepting a small gap at the ventral portion of the thorax, through which I suppose the animal would have wriggled out.

2. *A case of moult inside a 'closed burrow'.*

A fairly large larva, measuring about 55 mm. in length was left in a glass tray over moist earth on 1st March 1942. It was supplied regularly with snails, but the glow-worm did not feed. It was unusually very inactive. After 2 or 3 days it began to burrow into the earth and by the 9th a deep burrow was constructed against a side of the tray. The burrow was about 2 inches deep and the hollow inside was lined with a smooth surface. The animal had completely buried itself inside the burrow, which was closed with earth above. Occasionally by disturbing it I could see through the glass a bright glow inside the burrow. On 15th morning I saw the creature with a completely moulted skin attached to it. I took both the larva and its moult out and the larva of the fresh instar began to move about. The plates were very soft and delicate, but dark (dark, because ecdysis must have taken place a few hours earlier). The moulted skin had the usual linings of the tracheal tubes attached to it. These linings I could notice inside the hollow of the burrow only on the 15th. So I presume that the larva moulted on the 15th itself, but the whole skin was cast

in the course of a few hours, during which time the animal had assumed the dark colour. The skin is preserved dry.

3. *A case of moulting outside the burrow.*

Another case of moulting was noticed to take place outside. In this case no special burrow was constructed for moulting. The larva having a length of about 50 mm. was placed in a glass tray over moist earth on 1st March '42. It stopped feeding and gradually developed an aversion towards snails. It began to burrow but didn't proceed further. It came out again and lay coiled up, quite exposed and inactive. The only sign of life was observed in the sudden glow of the photogenic organ when hammered by the mounted needle. It also wriggled slightly when pricked. The plates grew darker and darker and the body was considerably narrowed. On 18th March, 1942, morning at 10 a.m., it was quite inactive and I took it to be dead. It was sooty black and the body shrunken very badly. At 2 p.m., to my surprise I discovered the larva in the act of moulting. The metathoracic and abdominal exoskeleton was detached and thrown out posteriorly. The pronotum and mesonotum were still attached to the body. The newly moulted individual was bright yellowish white. At 5 p.m., no further change was observed. But the skin was becoming less and less yellow and the larva was stretching the abdomen and relaxing itself. The skin covering the 2 posterior pairs of legs were cast already and so they were white. At 5-30 p.m., the animal wriggled out vigorously. Dorsally the pronotum and mesonotum were left and ventrally the prosternum and the skin covering the forelegs alone were left. Now it looked as though the animal had a helmet. The two posterior pairs of legs were moving and pressing against each other. The head was kept outside but not so fully thrust out as during locomotion. The dorsomedian line was seen as a white streak. The posterolateral margins of the terga were diaphanous. The 8th abdominal tergum grew very dark in the middle area. The anal brush was completely retracted inside and obviously it had no part to play in ecdysis. The skin gradually became dark and on 19th morning the chitin was completely turned black as in the normal active larvae. But the 'helmet' (or pronotal piece) was not cast till the following day.

MADRAS CHRISTIAN COLLEGE,
TAMBARAM,
April 14; 1943.

J. SAMUEL RAJ,
Department of Zoology.

XXIII.—THE FLOWERING OF *STROBILANTHES CALLOSUS* NEES.

Owing to the uncertainty of the flowering cycle of *Strobilanthes callosus*, locally known as the *Karvi*, I recorded the time of the general flowering which occurred in 1928 in volume xxxiv, p. 264, of the *Journal*, in the hope that some botanist might record the

next general flowering and thereby fix the length of the flowering cycle. In the note quoted above, I referred to 'forerunners' of the general flowering which showed up in August-September 1927. In 1942 'forerunners' appeared on the Western Ghats at Khandala. My son, Carl, wrote in 1942 to say that isolated bushes flowered at Abu. At present (1943) all the bushes at Khandala are full of buds, and my son wrote again recently to say that all the *Strobilanthes* at Abu are showing signs of flowering. Last week-end I noticed old plants at Mumbra, Thana District, also in bud. These records give us the flowering cycle of *Strobilanthes callosus* as fifteen years (1928-1943).

This is a hurried last-minute note to draw the attention of members to the general flowering of this species which will take place between September and November this year, 1943.

BOMBAY NATURAL HISTORY SOCIETY,

C. McCANN.

BOMBAY,

August 5, 1943.

PROCEEDINGS OF THE ANNUAL GENERAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of the Society will be held at the Prince of Wales Museum, on Thursday the 19th August 1943 at 6 p.m.

AGENDA

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.
4. Such other business as may be properly brought before the Meeting.

The Honorary Secretary announced the election of the following 92 new members since the last meeting held on 22nd July 1942:—

22nd July 1942.

- (1) Shri Bada Maharaj Kumar Sahib Hanwant Singh of Jodhpur; (2) Mr. G. Loucato, Bombay; (3) Mr. R. D. Leakey, Bombay; (4) Mr. A. Raptakos, Bombay; (5) Mr. Francis Low (Jr.), Bombay; (6) Major R. H. Beamish, No. 12 Advance Base P.O., India; (7) Mr. James A. Hall, M. E. Force; (8) Mr. R. F. Twist, Assam; (9) Mr. S. W. C. Dunlop, I.C.S., Bezwada; (10) Mr. R. S. Symons, I.C.S., New Delhi; (11) Professor of Zoology, Osmania University, Secunderabad, Deccan; (12) Mr. W. F. Penberthy, Calcutta; (13) The Principal, Dungar College, Bikaner; (14) The Honorary Secretary, Ahmednagar Club, Ahmednagar; (15) D. S. Vala Bawabhai, Talukdar of Babra, Kathiawar; (16) Dr. G. Heslop Harrison, Bombay; (17) Major J. W. Rawlins, New Delhi; (18) Major Peter Hook, New Delhi; (19) Lt.-Col. B. T. Phillips, I.A. (Retd.) Srinagar; (20) The Director of Industries, Bombay; (21) Capt. Aubrey Buxton, Bombay; (22) Lt.-Col. J. H. Blyth, I.A., New Delhi; (23) The Mother Superior, Oxford Mission, Behala, Calcutta; (24) Major G. M. Holland, Bombay; (25) Mr. W. T. Loke, Bombay; (26) Mr. E. K. Hari Krishna, Quetta; (27) Mr. H. J. Mitchell, B.F.S., Simla; (28) Mr. A. S. Laing, Bombay; (29) Mrs. Desires Proud, Simla Hills; (30) Mr. J. Walker, I. F. S., New Delhi; (31) W. Olmstead, Esq., New Delhi; (32) Mr. Brian Hocking, I.A.O.C., Cawnpore; (33) Mr. H. T. Mackett, Delhi; (34) Dr. V. N. Likhite, D.Sc., Mehsana, North Gujarat; (35) Lt. J. R. Armitage, Bombay; (36) Mr. K. Karunakaran Nayar, Trivandrum; (37) The Principal, Sikh National College, Lahore; (38) Mr. A. G. A. Beyts, Chitral; (39) Mr. W. L. French, Army Base P.O.; (40) Major F. J. S. Turner, Colombo; (41) Mr. C. L. Hamilton, Calcutta.

1st January 1943.

- (1) Mr. J. R. Scott, Bombay; (2) Mr. H. B. Hayes, Bombay; (3) Mr. G. H. Jolly, Middle East Force; (4) Mr. Owen Martin, Bombay; (5) Sgt. J. D. Romer, Bombay; (6) Mr. Eden Showers, Assam; (7) H. H. The Raja of Pudukkottai; (8) Mr. A. R. Haseler, Simla; (9) H. H. Maharaja Shri Brijendra Sawai Brijendra Singh Sahib Bahadur, Maharaja of Bharatpur; (10) Dr. V. Prabhakar Rao, M.A., D.Sc., Bombay; (11) Dr. C. C. John, M.A., D.Sc., Trivandrum; (12) Stewart Brown, Bombay; (13) The Director, Drug Research Institute, Jammu Tawi; (14) Major J. N. Reeve, R.A., Bombay; (15) Major I. A. Pace, Bombay; (16) Sgt. A. F. Armstead, Singapore; (17) Miss M. F. Barber, Mudis P.O.; (18) The P.R.I. No. 26, Prisoner of War Camp, Yol, Punjab; (19) Mr. J. T. D. Savary, Sind; (20) Capt. A. D. Hunter, No. 6.

Advance Base P.O., India; (21) Mr. Rufus H. Le-Fevre, U.S.A.; (22) Lt.-Col. E. L. Farley, C.B.E., M.C., Mhow; (23) Mr. S. N. Elijah, Belgaum; (24) Dr. P. Dharma Pal, L.M.S., Mudis P.O.; (25) Mr. E. H. Clarke, Jullundur; (26) Major R. Holmes, M.B.E., Bushire; (27) Major T. D. Mills, Dinapore; (28) Mr. M. R. Coggin, Travancore; (29) Sgt. P. V. Hicks, A.B.P.O. No. 21, India; (30) The President, Mess Committee, Chindwara, C.P.; (31) Major-General H. J. Manockjee Cursetjee, Bombay; (32) Mr. W. J. Cullen, Karachi; (33) Lt. G. L. Randall, R.E., Lahore; (34) The Instructor, Eastern States Forest School, Champua P.O.; (35) Mr. M. J. P. Cruttwell, Mussoorie; (36) Capt. C. R. Stoner, No. 14, Advance Base P.O.; (37) Mr. N. B. Banarjee, Meerut; (38) Major F. R. McL. Moodie, I.E., Roorkee; (39) Lt.-Col. D. C. MacLeod, New Delhi; (40) Mr. James A. Hislop, Bombay; (41) Rev. Dr. J. B. Freeman, Chingleput; (42) Capt. C. Rea, Kakul; (43) Major J. D. Olivier, R.A., Campbellpore, Punjab; (44) Mrs. K. I. Barlow, Peshawar; (45) Capt. Ph. E. Milon, Egypt; (46) Major L. D. J. Turnbull, Calcutta; (47) F/O T. R. Garnett, Indian Command; (48) Mr. Alfred S. Paines, England; (49) Lt. P. W. Hinde, Bombay; (50) Lt. P. I. R. Maclaren, R.I.A.S.C., Rawalpindi; (51) Mr. John Dewar, Jalpaiguri.

OFFICE BEARERS—1943.

The following gentlemen were elected to serve on the Managing Committee:—

President.—H. E. The Right Hon'ble Sir John Colville, G.C.I.E., T.D.

Vice-Presidents.—Rev. Father J. F. Caius, S.J., F.L.S. and Rt. Rev. R. D. Acland, M.A.

Executive Committee (Bombay).—Mr. Humayun Abdullaly; Mr. Salim Ali; Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, C.B.E., M.L.A., J.P.; Mr. R. E. Hawkins; Mr. D. G. Hill, F.R.G.S., J.P.; Dr. M. Sharif, D.Sc., Ph.D., F.N.I.; Lt.-Col. S. S. Sokhey, I.M.S.; Mr. F. Wadia; Mr. T. E. Savaides (*Hon. Treasurer*); Revd. Fr. J. F. Caius, S.J., F.L.S. (*Hon. Secretary*).

Advisory Committee.—Dr. N. L. Bor, M.A., D.Sc., F.L.S., Assam; Lt.-Col. R. W. Burton, I.A. (Retd.), Bangalore; Mr. M. B. Dalal, Bombay; Mr. C. H. Donald, F.Z.S., Dharamsala; Dr. F. H. Gravely, D.Sc., Kodaikanal; Mr. C. M. Inglis, B.E.M.B.O.U., F.Z.S., Darjeeling; Mr. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian-Adams, F.Z.S., I.A., Bangalore; Dr. Baini Prashad, D.Sc., Calcutta; Mr. H. C. Smith, I.F.S., Simla; Mr. J. H. Williams, Coimbatore.

Staff.—Mr. S. H. Prater, O.B.E., M.L.A., J.P., C.M.Z.S. (*Curator*) and Mr. C. McCann, F.L.S. (*Assistant Curator*); A. F. Fernandes (*Head Clerk*).

Proceedings concluded with a vote of thanks to the Chair.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER, 1942.

ADMINISTRATION.

President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—Rev. Fr. J. F. Caius, S.J., F.L.S., and Rt. Rev. R. D. Acland, M.A.

Executive Committee (Bombay).—Mr. Humayun Abdulali; Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, C.B.E., M.L.A., J.P.; Mr. R. E. Hawkins; Mr. D. G. Hill, F.R.G.S., J.P.; Dr. M. Sharif, D.Sc., Ph.D., F.L.S.; Lt.-Col. S. S. Sokhey, I.M.S.; Mr. F. Wadia; Mr. T. E. Savaides (*Honorary Treasurer*); Rev. Fr. J. F. Caius, S.J., F.L.S. (*Honorary Secretary*).

Advisory Committee.—Mr. Salim Ali, Dr. N. L. Bor, M.A., D.Sc., F.L.S., I.F.S., Dehra Dun; Lt.-Col. R. W. Burton, I.A. (Retd.), Bangalore; Mr. C. H. Donald, F.Z.S., Dharamsala; Dr. F. H. Gravely, D.Sc., Kodaikanal; Mr. C. M. Inglis, B.E., M.B.O.U., F.Z.S., Darjeeling; Lt.-Col. R. C. Morris, F.R.G.S., F.Z.S., Coimbatore; Major E. G. Phythian-Adams, I.A., F.Z.S., Bangalore; Dr. Baini Prashad, D.Sc., Calcutta; Mr. H. C. Smith, I.F.S., Simla; Mr. J. H. Williams, Coimbatore.

Staff.—Mr. S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*); Mr. C. McCann, F.L.S. (*Asst. Curator*).

THE HONORARY SECRETARY'S REPORT FOR THE
YEAR 1942.

THE SOCIETY'S JOURNAL.

Three numbers of the forty-third Volume of the *Journal* were published during the year.

MAMMALS.

Papers on Mammals include Part I of Mr. Pocock's study of the larger Indian deer. Scientific literature on the species of deer inhabiting British India is limited mainly to descriptions of their antlers and other external features. The present contribution provides detailed descriptions of the skulls, indicating resemblances and differences in cranial characters. Four Elapine species are dealt with. Two of them, the Kashmir *Barasingh* or Hangul and the Shou are known to occur within our limits. Wallich's Deer is found in Tibet. The fourth species, Przewalski's Deer (*Przewalskium albirostris*) is included in the Indian list on the evidence of a head-skin and skull obtained in the Darjeeling Bazar. A key summarising distinctions between the 4 species will help both students and laymen to identify these little known deer by their external and cranial characters.

Dr. W. C. Osman Hill, Professor of Anatomy at the Colombo Medical College, describes a new race of Slender Loris under the name *Loris tardigradus nycticeboides* from an adult male and female and two young obtained from the Horton Plains (alt. 6,000 ft.) in Central Ceylon. In a second paper, Dr. Hill deals with the Tocque Macaques (*Macaca sinica*) of Ceylon. Pocock in his recent volume on Mammalia distinguishes two races—the typical form, *M. s. sinica*, found in the dry zone of the lowlands and a hill race *M. s. aurifrons*, inhabiting the central hill ranges and the lower jungles of the wet zone. A study of Tocque monkeys collected from the uppermost levels of the Central Range led to the conclusion that they represent a distinctive race to which Dr. Hill assigns the name *M. s. opisthomelas*. This, the real highland race, occupies the uppermost of the three geographical terraces composing the land structure of the island, while *M. s. aurifrons*, from the lower or intermediate levels, is an annexant race between the highland and the lowland forms.

BIRDS.

Mr. Salim Ali's paper on the Birds of Mysore embodies the results of a survey of the State carried out conjointly by the Society and the American Museum of Natural History, New York. A survey of Mysore was especially necessary to complete the data obtained as a result of surveys in the Eastern Ghats and Southern India, which indicate that the intervening territory of Mysore is a meeting ground of the distinctive racial forms inhabiting the eastern and western parts of the Peninsula. Our thanks are due to the Mysore Darbar for financial help and other facilities given to the Society in carrying out the Survey. In the introduction to his report Mr. Ali discusses the Physiography and Meteorology of

Mysore, associating his study of environmental factors with the distribution of species. An attempt is made to fix provisional habitat types by distinguishing species which inhabit dense evergreen forest, those found in deciduous forest and those confined mainly to an intermediate mixed biotope. These ecological studies are a step to the better understanding of factors underlying distribution of species and the evolution of racial forms. In India they offer naturalists a wide field of neglected exploration. Mr. Ali's paper shows the lines upon which this work can be done. The survey was also instrumental in settling a number of questions about the racial status, plumage, breeding, and movements of a number of species. We must thank Mr. Ali for his interesting report and Mr. Whistler for his taxonomical study of the collections obtained by the Survey.

A useful supplement to previous literature on Central Indian Birds is a paper on the Birds of Berar by Mrs. M. D. Wright. The birds of the higher levels of the Karen Hills and Kareni, Burma, by Messrs. Smith, Garthwaite and Smythies is the first connected account of the birds of this area. Readers of our *Journal* will be glad to hear that the authors have been able to bring away from ill-fated Rangoon most of the blocks and original paintings used for their fine work on the Birds of Burma. From the many enquiries we have had for this book we may assure them that a second edition is awaited by many.

Additional notes on the Birds of Northern Baluchistan, supplementing the late Dr. Ticehurst's papers on the Avifauna of the country were written by Major-General A. F. P. Christison. The paper deals with new records and settles questions relative to a number of species of which the racial status has been in doubt. Obviously, a great deal of exploratory work remains to be done in Baluchistan, a promising field for Ornithologists stationed in the country.

Among the local lists published during the year is a paper on the Birds of Londa, North Canara, by Walter Koeltz in which reference is made to a large number of new races of birds originally described by the author in the Proceedings of the Biological Society of Washington. Mr. Whistler's study of and comments on these new races, published as an addendum to Mr. Koeltz's paper, emphasizes the need for greater restraint in establishing new races without adequate material for comparative study. This from the nature of his deductions, Mr. Koeltz obviously did not have, the majority of new races described by him cannot stand.

Mr. Humayun Abdulali gives an account of a second visit to the Vengurla Rocks—off the Ratnagiri Coast—the breeding grounds of various terns and of edible-nest swifts. To the local breeding records of *Sterna bergii*, *S. anaetheta* and *S. repressa* we may now add *S. dougalli* and *S. fuscata*—the Sooty tern, whose nearest hitherto known breeding place was the Laccadives. The party spent much of the time investigating the breeding cave of the swifts. Some 5,000 of them swarmed home to roost after dark and could be seen by torchlight clinging close-packed to the rock face and to their nests, looking extraordinarily like bats. Many

of the nests appeared to have been replastered with saliva, suggesting that they may be used more than once. All were empty. Breeding probably takes place later in the year when the on-coming monsoon makes this forbidding, wave-beaten islet wholly inaccessible.

An interesting and well illustrated account of the nesting habits of the Indian Courser was contributed by Mr. W. W. A. Phillips.

Mr. E. H. N. Lowther writes his notes on Indian Birds with all that insight and sympathy which comes from many hours of patient bird-watching. His subject is Indian Hornbills, about whose unique nesting habits much that is precise yet remains to be known. Does the imprisoned female leave the nest before her eggs are hatched? Habits may vary with different species. In the instance of our Common Grey Hornbill (*I. birostris*) Mr. Lowther's answer based on observations made at three different nests is definitely—no. Again, in the case of this species, the bulk of evidence shows that the female alone builds the enclosing wall of the nest. Analysis of fragments of the wall, sent by the author to the Society, reveal that it is built up of earth and animal excreta mixed together with pieces of bark, hay, etc., collected from the nest hollow. Food for the imprisoned female is carried by the male in his gullet and feeding is effected by regurgitation. The female Grey Hornbill does not leave the nest till the young are about a fortnight old, not infrequently when they are about ready to fly. She lets herself out unaided by the male, breaking down the nest wall with hammer strokes of her bill. The wall may or may not be rebuilt to provide continued protection for the young. Whether the parents rebuild the wall or whether, as in the case of certain African species, it is rebuilt by the young is a question which remains to be answered. Mr. Lowther's informative notes are, as always, illustrated with his fine photographs.

Excellent also are Col. Bates' pictures of birds taken during a brief holiday in the great deodar forests of the Kazinag range. His notes and photos were a feature of the April number. Readers of our *Journal* have reason to be grateful both to Mr. Lowther and to Col. Bates, whose pictures and writings add so much to the attractiveness of its pages. At no small sacrifice they maintain the fine tradition of voluntary effort upon which the repute of this *Journal* has been built.

REPTILES AND FISHES.

We were able to publish only one part of Dr. Hora's serial on the Game Fishes of India, as high costs of printing impose a more rigid limitation on the number of coloured plates included in each issue. In his six previous articles Dr. Hora described various species of 'Mahseer' from the rivers of North India, he now turns to the Mahseer of the Deccan from whence a confusing number of species have been described. We take this opportunity of offering our congratulations to Dr. Hora on his appointment as Director of Fisheries, Bengal. The Bengal Government is fortunate in securing the services of a man of his knowledge and ability. It is hoped that Dr. Hora will have time to continue his scientific work and

that Indian Ichthyology will not be wholly deprived of the services of one who is making so great a contribution to its progress. The fishes of the waterways of the Deccan also form the subject of a report by Capt. Fraser, who collected some 2,800 specimens in Poona and its environs. Dr. Fraser's general account of the various localities in which fishes were collected and the species obtained in each is followed by his notes on the ecology and bionomics of certain forms. His collection was studied by Dr. Hora and K. S. Misra who give a list of Poona fishes, with their Hindi names, and their distribution. Of special interest is the discovery within this limited area in India of certain species hitherto known to occur only in Burma, Siam and Malaya, suggesting the Malayan affinities of the Fauna of this part of the Western Ghats. The thanks of the Society are due to Capt. Fraser for the work he has done, the greater part of his fine collection is now in our Museum. Yet another student of the Fish Fauna of Poona is that enthusiastic fisherman, Dr. M. Suter who contributes his observations on the breeding coloration of *Barbus kulos*. A handsome breeding livery is customarily donned by males of this group of fishes, but with this carp it is the female who attracts attention to herself with the gaiety of her bridal apparel. The coloured plate accompanying the article is based on an original coloured sketch by Dr. Suter. We thank him for contributing towards the cost of its reproduction and for the many ways in which he has helped Dr. Hora in his study of the fish fauna of his neighbourhood. Dr. Hamid Khan's paper on the 'Spawning of Carp and their Spawning grounds in the Punjab' is a contribution to better knowledge of this group of Indian fresh-water fishes. The supply of these fine food fishes, economically the most important in our rivers, is at present dependent entirely on natural spawning. As such, improvement of our inland fisheries depends substantially on the measures taken for their protection from wholesale destruction during the breeding season and upon the facilities which can be given them to reach their natural spawning grounds. Neglect of these provisions has implied and continues to imply neglect of an important and valuable source of food supply to the people of the country. The series of articles on the Game Fishes of India, written mainly from the scientific aspect, were directed to provide, in the first instance, accurate information about their status and distribution. But knowledge of fish is one thing and knowledge of fishing is another. We feel therefore that no better pendant to Dr. Hora's work in our *Journal* could be provided than Mr. A. St. J. Macdonald's serial on 'Circumventing the Mahseer and other Sporting Fish in India and Burma'. Mr. Macdonald writes for the young angler and for those of lesser experience, giving them generously all that hard won knowledge of fish and fishing which leads to the mastery of the gentle art and to the making of a good fisherman. Many fish have been taken and much water has flowed from the rivers to the sea since Thomas wrote his classic 'Rod in India'. To the sum of what was then written Mr. Macdonald adds much that is new both in practice and precept. When Macdonald's serial finally appears in book form it will become the new *vade mecum* for anglers in India.

INSECTS.

Papers on insects include parts IX and X of Mr. Sevastopulo's study of the Early Stages of the Indian Lepidoptera, and a paper by Mr. M. C. Cherian on *Goniozus indicus*, a natural enemy of the sugarcane White Moth borer (*Sciophaga rhodoprotalis*).

BOTANY.

Parts X, XI and XII of the serial on 'Beautiful Indian Climbers and Shrubs' by Dr. N. L. Bor and M. B. Raizada, published during the year, deal with the *Solanaceae* and the *Verbenaceae* which include so many attractive garden plants. Father Caius continued his serial on Indian medicinal and poisonous plants; the August number of the *Journal* contained his paper on the Medicinal Mallowworts of India. As with all the *Malvaceae* none of these plants are poisonous, but many are well known for their emollient and tonic properties. Parts IX and X of Mr. M. Sayeedud-Din's serial on Common Indian Herbs were issued. Mr. McCann's paper on Indian Duckweeds (*Lemnaceae*) is an important contribution to the study of a little known order of plants, much neglected by Botanists. The author clarifies the confused status of Indian species and records fresh observations made over many years both in the field and the herbarium. Dr. Kundu's Revision of the Indian species of *Hodgsonia* and *Trichosanthes* revises the classification and nomenclature of the two genera, and assembles in one paper the large number of species discovered and described by various workers in numerous scattered publications. Such revision of most of the families of Indian plants described in Hooker's 'Flora of British India' is long overdue. Appreciative reference must also be made to Professor D'Almeida's intensive study of Indian marsh and aquatic plants which adds much new information to what is recorded in the various Floras. Mr. Abdul Hameed's paper on the Liverworts of the Murree Hills introduces laymen to an obscure but none-the-less important division of the Plant Kingdom. His paper contains notes and illustrations of some 23 different species from the Murree Hills.

GENERAL.

More reminiscences of happy hunting days on the banks of the Narbudda come to us from the pen of Col. Burton, whose articles never fail to recapture the charm of leisurely days in field and forest given now to few to enjoy. Mr. McCann's 'Busman's Holiday in the Abu Hills' is a miscellany of interesting notes on plants, animals and birds, written by one whose sole absorption at work or at play is the world of Nature.

We cannot conclude this review of the papers published during the year without expressing our thanks to all those who contributed to the Miscellaneous Notes which have always been a feature of our Journal and a source of special interest to most of its readers. Despite increasingly rigorous conditions imposed by the War, we have endeavoured to maintain the standard of the Society's Journal, but the Council of the Society feels that we cannot altogether escape

the fate that has befallen so many kindred publications and that a stricter limit must be placed to the number of its pages and illustrations. This naturally raises the difficulty of finding space for numerous papers received, and of maintaining unbroken the sequence of various current serials, but we are certain that members will bear with us. Their support and cooperation will help the Society to tide over these critical times, and to continue its work, till happier days restore to the full the measure and scope of its many activities.

PUBLICATIONS.

The first edition of Salim Ali's Book of Indian Birds published in 1941 was sold out almost within the year. A second revised and enlarged edition containing additional plates and descriptive matter is now in the press and will be available shortly. There is a demand for well written and well illustrated books on Indian Natural History. So far, such literature has been limited mainly to technical works or costly books unintelligible to—or beyond the reach of the public. The Book of Indian Birds has served its precise purpose—readable, attractive and inexpensive, it has appealed to a wide public. Its immediate success has encouraged the Society to consider the publication of companion volumes in the same style and format. The Book of Indian Animals is now in course of preparation by Mr. Prater, whose serial on the Wild Animals of the Indian Empire was published in the *Journal* some years ago. Mr. Prater's book will deal with the commoner Mammals of India. It will be well illustrated in colour, and black and white, and will include descriptive accounts and general chapters in the manner of the Book of Indian Birds.

Another book now in preparation is a work on the Poisonous Land Snakes of India. It is many years since the fourth edition of the Poisonous Terrestrial Snakes of India by Col. Wall went out of print. Part I of the new work has been written by Dr. Malcolm Smith, author of the new edition on Indian Reptiles in the Fauna of British India series. Parts II and III dealing with snake venoms and the treatment of snake bite was to have been written by Dr. Burgess Barnett, whose researches into the application of snake venoms in surgery and medicine have attracted considerable attention. On the outbreak of War with Japan Dr. Barnett, we understand, offered his services to the Military and we regret that we have not heard from him since. The Society has however been fortunate in securing the help of Lt.-Col. Sokhey, Director of the Haffkine Institute, Bombay, who has undertaken the preparation of Parts II and III. The book will provide an up to date and authoritative work on Indian Poisonous Snakes and the treatment of snake bite.

The Nature Calendars issued annually by the Society have been an outstanding success. We received numerous letters congratulating us on the excellence of the Calendar published in 1942 and were, unfortunately, unable to meet the unexpectedly large demand. Our special thanks are due to Col. Bates, to Mr. Lowther and others

whose fine photos contributed so much to the attractiveness of these Calendars, which are a welcome source of much needed revenue to the Society.

REVENUE ACCOUNT.

Our total revenue amounted to Rs. 38,665-3-7 as compared with Rs. 24,887-12-5 in the previous year. The increase was mainly due to receipts from sales of publications. Receipts from subscriptions amounted to Rs. 16,622-5-5 as against Rs. 16,101-6-10 in the previous year. The loss of Malaya and Burma where we had many members, and loss of contact with so many now serving in various fronts have considerably depleted this main source of constant revenue. On the other hand while expenditure on salaries and staff has been maintained at pre-war level, we are faced with increasing costs in almost every direction. It is confidently hoped that every effort will be made by the members to ensure the continuity of their support and the continuity of the Society's work.

DONATIONS.

The Council of the Society, on behalf of its members wish to acknowledge with gratitude the handsome donations of Rs. 5,000 each, made by their Highnesses the Maharao of Kutch and the Maharaja of Bikaner both of whom, on their recent accession, honoured the Society by becoming its Vice-Patrons. Our thanks are also due to all those who generously contributed to the special fund created to meet the increased cost of the *Journal*. The following is a list of donations received:—

		Rs. A. P.
Trustees of the late Mr. F. V. Evans	...	1,189 10 5
Janjira State	...	250 0 0
Morvi State	...	500 0 0
Junagadh State	...	100 0 0
Mayurbhanj State	...	1,000 0 0
<hr/>		
Total	.	<u>3,039 10 5</u>

MEMBERSHIP.

68 new members joined as against 48 in the previous year. 32 resigned as against 24 in 1941.

After deductions made owing to death, or non-payment of subscriptions the total membership inclusive of Life Membership was 974 as against 992 in the previous year.

OBITUARY.

The death of H.H. Shri Kengarji Maharao of Kutch was a sad loss to the Society which for many years enjoyed his patronage and support. An obituary notice in the *Journal* of the Society pays tribute to the memory of His Highness, a Patron and a friend of the Society, a sportsman and a great gentleman,

ACKNOWLEDGMENTS.

We offer our grateful thanks to Mr. W. S. Millard who since he retired from the Honorary Secretaryship, some 25 years ago, has continued to look after the Society's affairs in London. His constant and willing help has meant much to us.

STAFF.

The Committee once again wishes to record its appreciation of the services of the Curator and staff whose loyal and devoted service is helping the Society to carry on in these critical times.

J. F. CAIUS,
Honorary Secretary.

10th *July* 1943

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER, 1942.

LIABILITIES	Rs	A	P	Rs	A	P	Rs	A	P	Rs	A	P
<i>Life Membership fees ;</i> <i>monies for specific purposes unexpired :</i>				55,125	0	0	55,125	0	0	55,125	0	0
Ornithological Survey ***	1,448	13	0	Rs. 34% <i>Investments—At holding value or Market value whichever is lower :</i>						30,675	0	0
Donations from States for 1943 ***	12,350	0	0	Rs. 15,000 5% Loan 1947-50 ***			15,000	0	0	15,000	0	0
<i>Boundary Creditors :</i>				Rs. 15,000 5% do. 1945-55 ***			15,000	0	0	15,000	0	0
Mr. E. C. Stuart Baker : Account Game Books ***	817	3	8	Rs. 14,000 4% Bombay Port Trust Bonds, 1945-55 ***			14,000	0	0	10,750	0	0
Brig. W. H. Evans : Account Butterly Books ***	250	0	0	Rs. 15,000 4% Bombay Improvement Trust Bonds 1945-55 ***			15,000	0	0	11,400	0	0
For Expenses (Audit, Fee)	2,200	0	0	Rs. 5,000 3½% Pro-Note 1945-55 (out of donation received from H.E.H. the Nizam) ***			5,000	0	0	4,687	8	0
The Diocesan Press, Madras, Journal Account ***	3,795	5	10	Rs. 89,000 (Market Value at 31st Dec. 1942 Rs. 95,440) ***			89,000	0	0	82,342	8	0
<i>Monies from H.E.H. the Nizam for Expenses :</i> ***	5,000	0	0	<i>Cast up—</i>								
With National Bank of India, Ltd., Bombay, (inclusive of Rs. 2115 out of donation received from H.E.H. the Nizam) ***	12,274	6	0	With National Bank of India, Ltd., London, £1007-8-10 at 1/6 ***			1,322	3	6	13,863	9	6
On Hand ***	250	0	0	On Hand ***			250	0	0	724	8	0
<i>Services & Advances to Staff :</i> ***				<i>Services & Advances to Staff :</i> ***			720	9	0	720	9	0
Expenditure on Book on Climbing Shrubs and Snakes ***	1,688	12	4	Expenditure on Book on Climbing Shrubs and Snakes ***			1,688	12	4	1,683	12	4
Total ***	23,510	12	0	Total ***			75	0	0	1,845	0	0
<i>Furniture :</i> ***				As per last Balance Sheet ***			1,840	0	0	1,840	0	0
<i>Less—Depreciation... :</i> ***				Less—Depreciation... ***			25	0	0	25	0	0
Total ***	1,01,229	14	10	Total ***			1,815	0	0	1,815	0	0

Note.—A stock of 22,100 old Journals, and the valuable research collections and Library of 2,710 volumes have not been taken into account on the Assets side of the Balance Sheet.
We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the Investments.
In our opinion, such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and

BOMBAY: 1943

(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants. Auditors.

sd.) T. E. SAVAIDES,
Honorary Treasurer.

BOMBAY NATURAL HISTORY SOCIETY.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1942.

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1942.

PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1942.					
	Rs A P	Rs A P	Rs A P	Rs A P	Rs A P
To Book on Climbing Shrubs : Expenditure to 31st December, 1941 Expenditure during the year to 31st December, 1942	628 1 4 1,060 11 0		1,088 12 4	By Balance carried to Balance Sheet	1,686 12 4
Book on birds by Salim A. Ali : Balance as per last Balance Sheet ... Profit carried to Revenue Account ...	747 3 7 12,392 5 3		13,139 8 10	.. By Sale Proceeds of Indian Bird books	13,139 8 10
, Book on Poisonous Terrestrial Snakes ...			75 0 0	.. Balance carried to Balance Sheet	75 0 0
.. Printing Charges of Calendars Profit carried to Revenue Account ...	2,562 1 3 1,750 2 3		4,352 3 6	.. Sale Proceeds of Calendars ...	4,352 3 6

Cr.

ORNITHOLOGICAL SURVEY ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1942.

	ORNITHOLOGICAL SURVEY	RS A P		RS A P		RS A P		
		RS	A	RS	A	RS	A	
To Balance carried to Balance Sheet	...	1,488	13	0	1,488	13	0	
				By Unexpected balance Sheet	as per last			
				... Balance Sheet	... as per last			
						
				•	•			
Total	...					1,488	13	
						0	0	
						Total	...	
							1,488	13
							0	0

MOMBAY, 1943.

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.,
Chartered Accountants, Auditors.

(Sd.) T. E. SAVAIDES,
Honorary Treasurer.

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INFORMATION WANTED

In 1935 or 36, the late Mr. F. Dawson, then Deputy Inspector General of Police at Madura, wrote me that most of his notes on birds were made in the interleaved volumes of Oates' Blanford's 'Fauna of British India—Birds', which were at that time in Belgaum. Soon afterwards, Mr. Dawson retired and went to England to continue his work on birds, which was interrupted within a year by his untimely death. If these particular volumes of the 'New Fauna' are still in India, I would be very glad to hear from their present owner. They must contain much valuable material about nests, which Mr. Dawson was expert in finding.

REV. E. G. NICHOLS,
Correspondent, A.M.C.C. Schools,
Batlagundu, Madura Dist.

2nd August 1943.

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